POPULAR SCIENCE

March 1949

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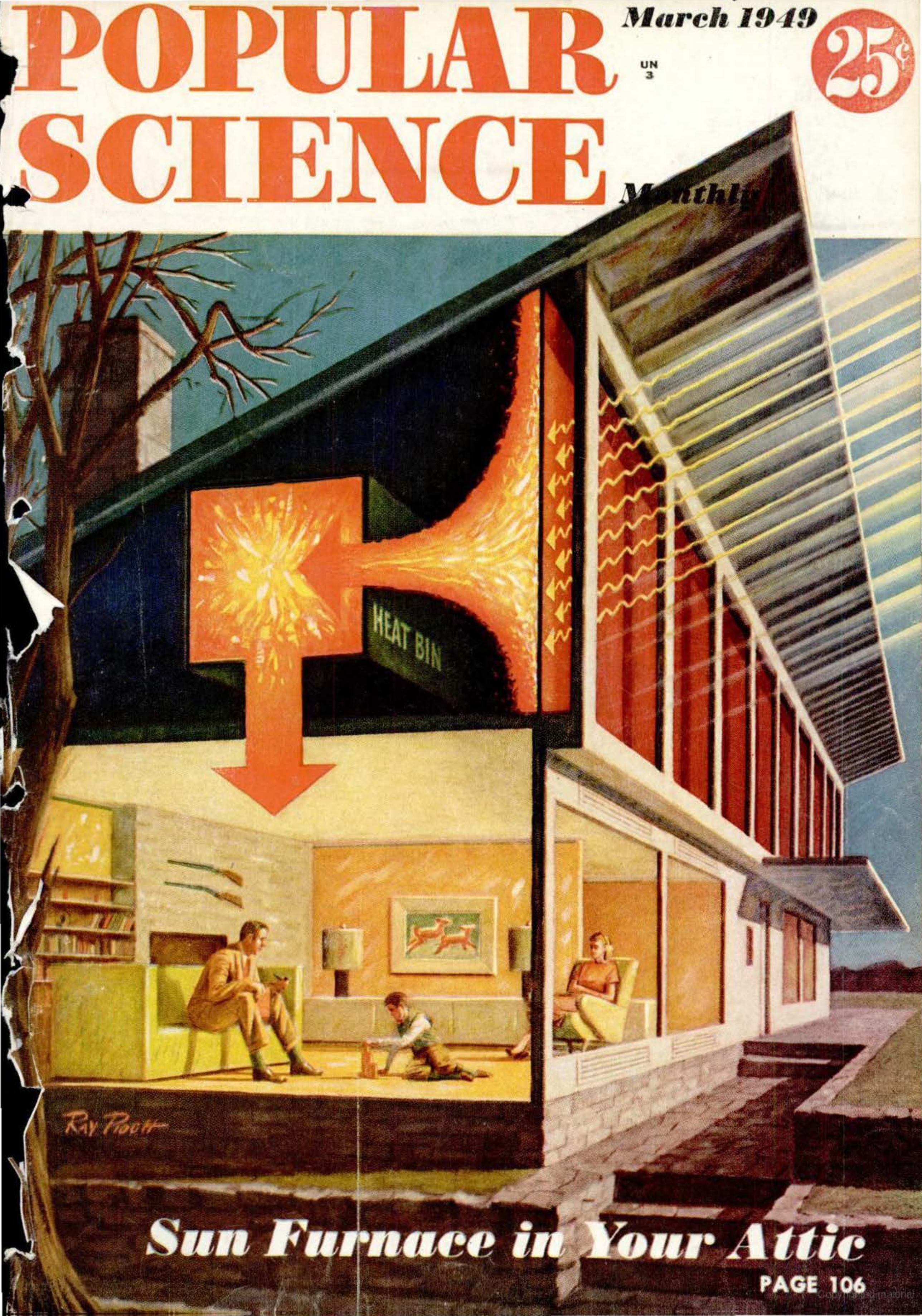

Sun Furnace in Your Attic

PAGE 106

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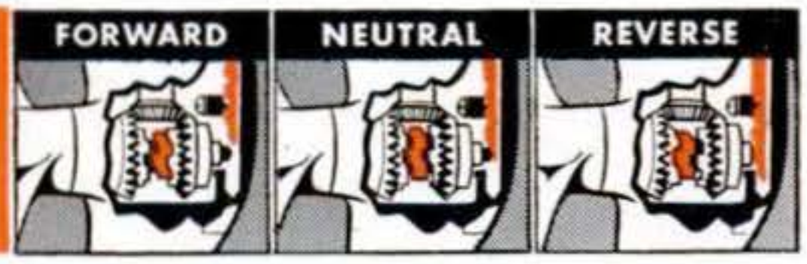

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POPULAR SCIENCE

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VOL. 154: NO. 3

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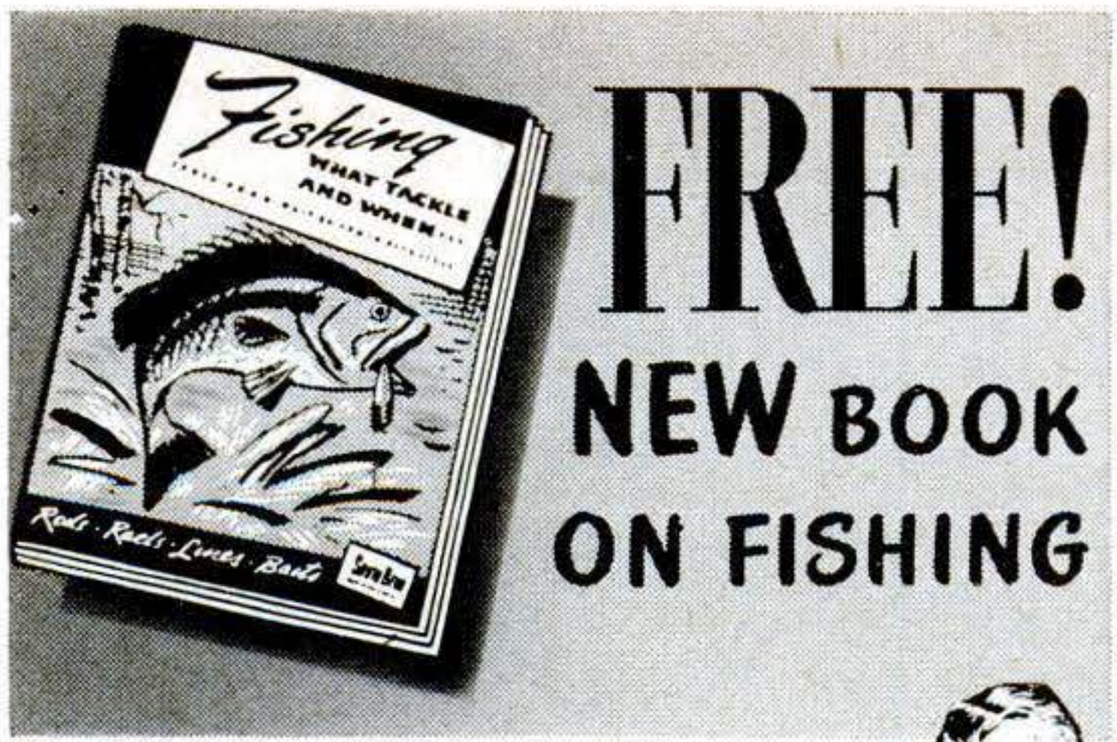

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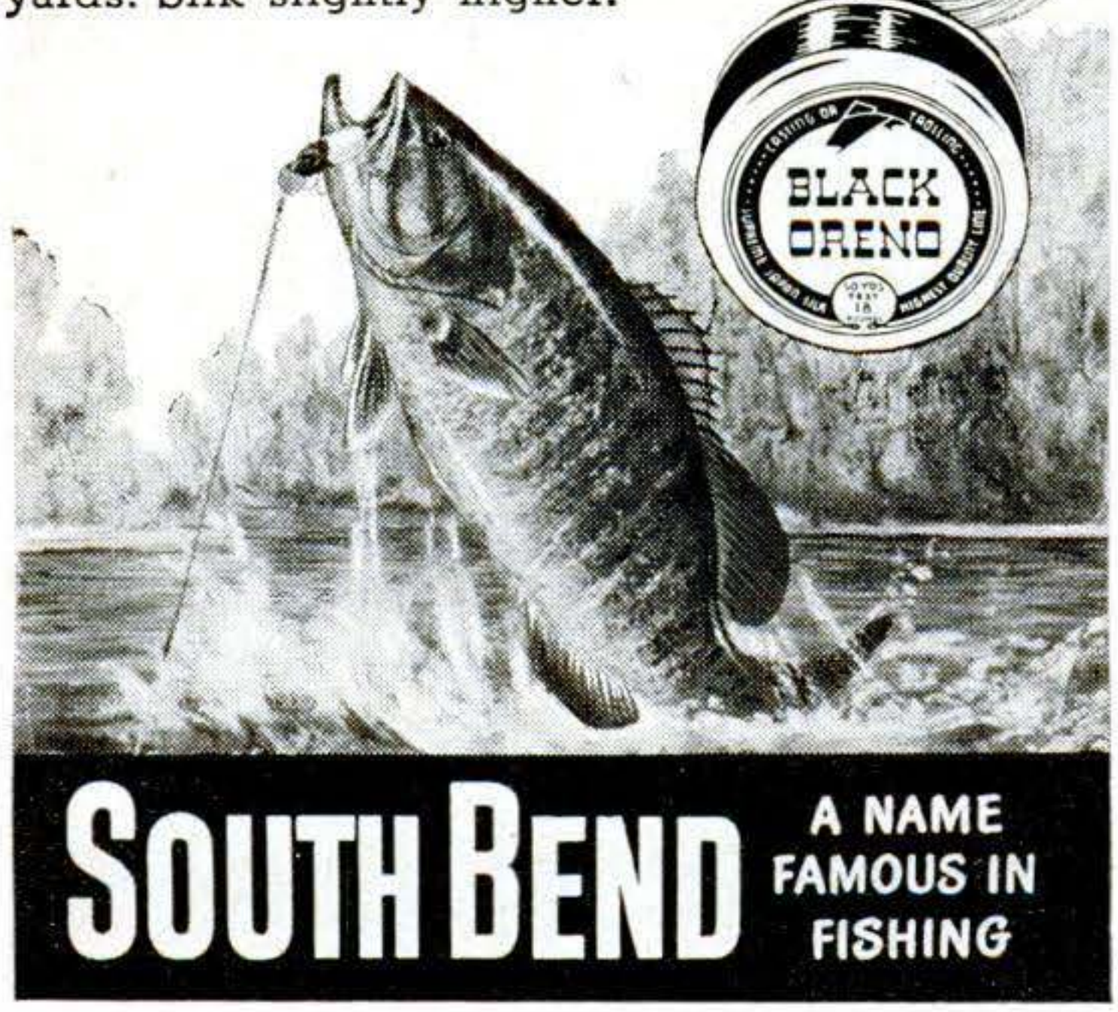

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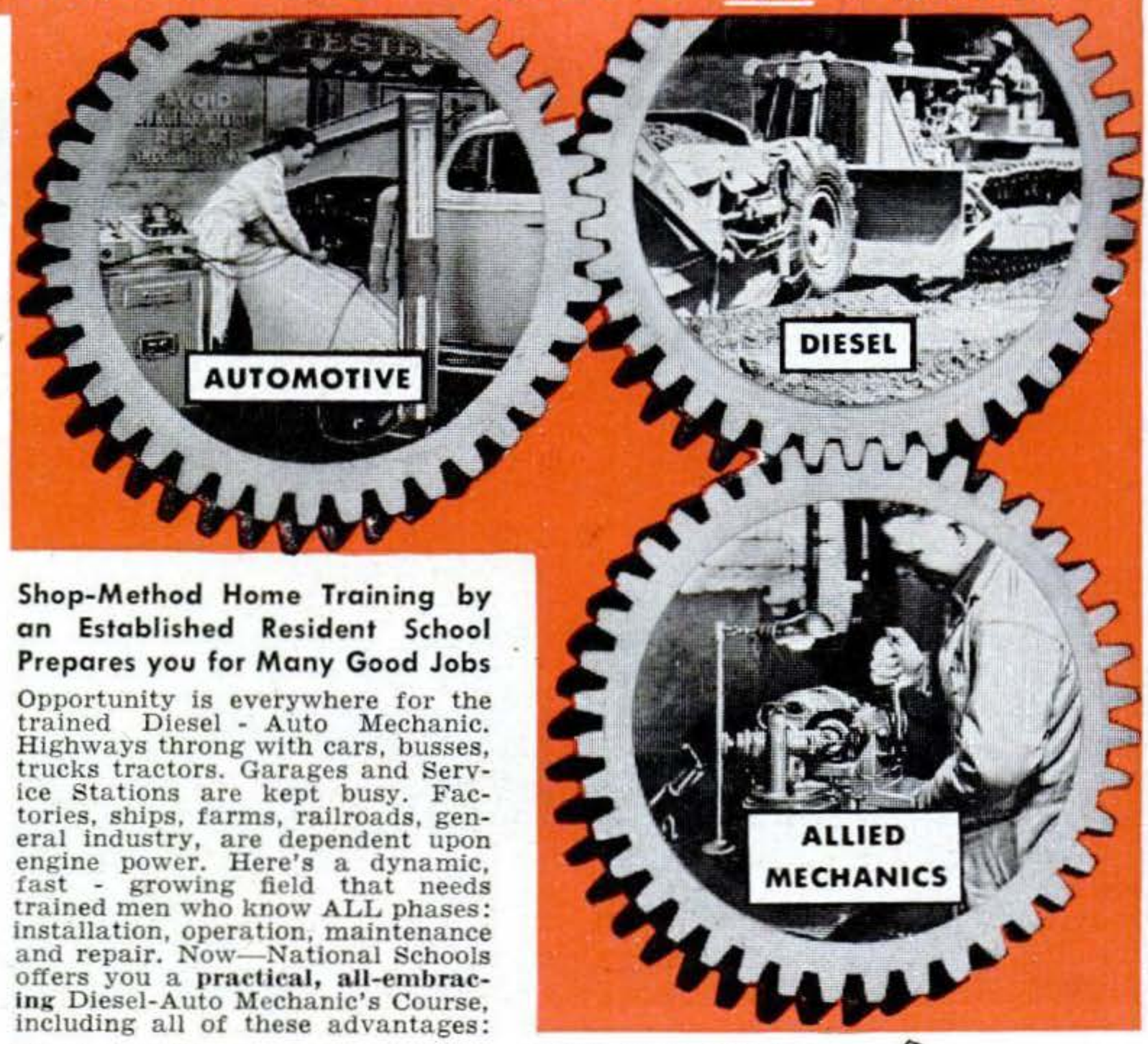

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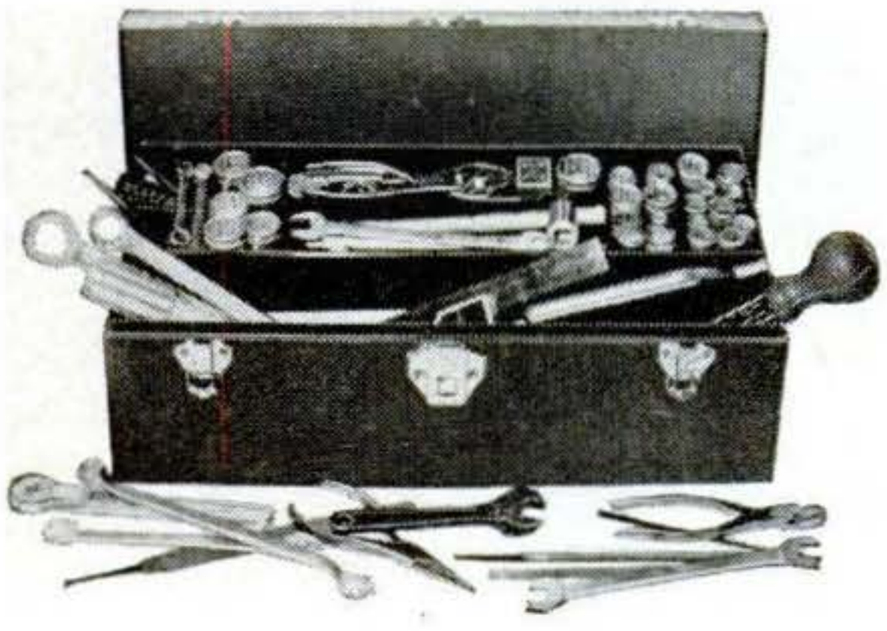

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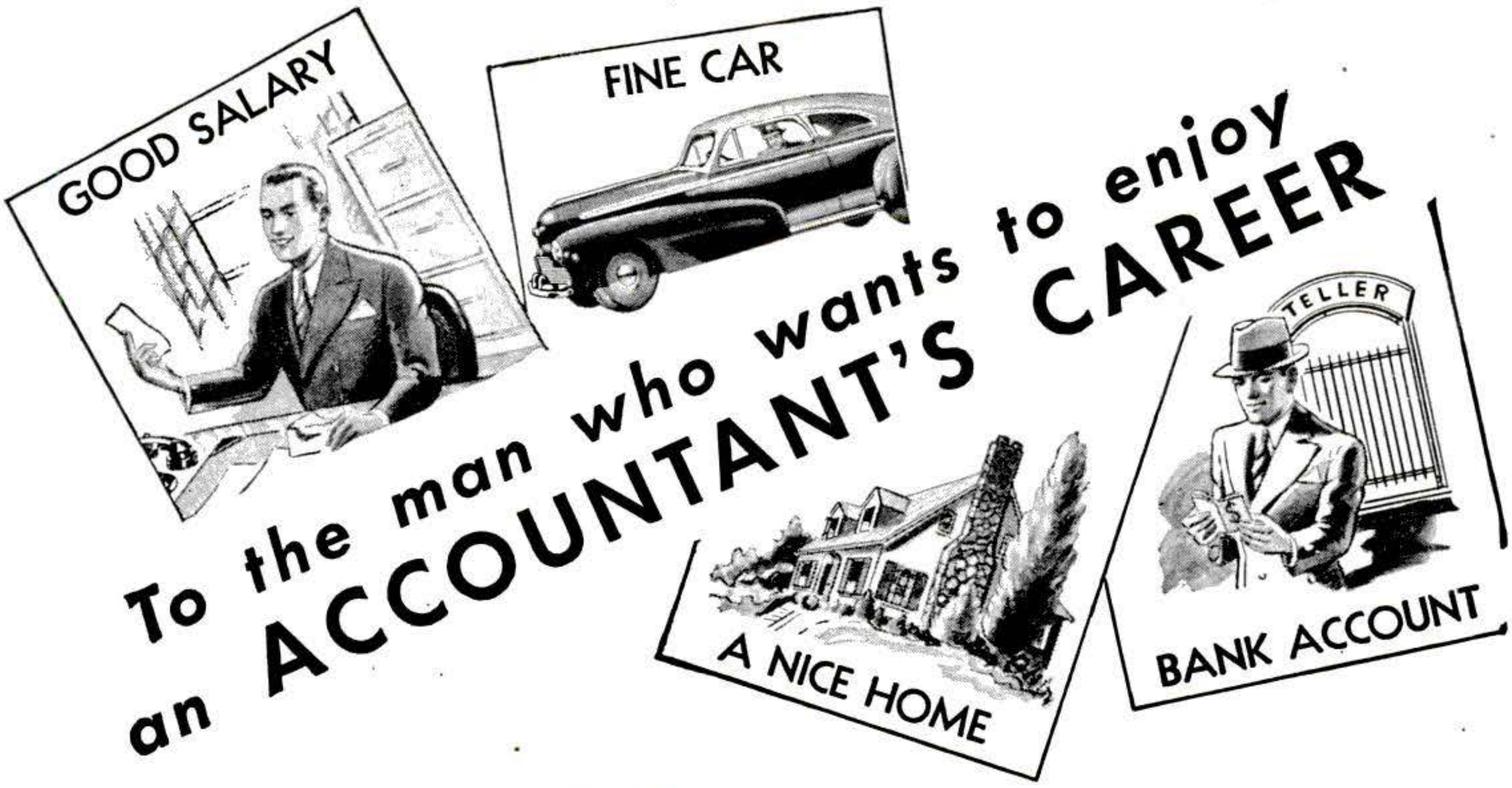

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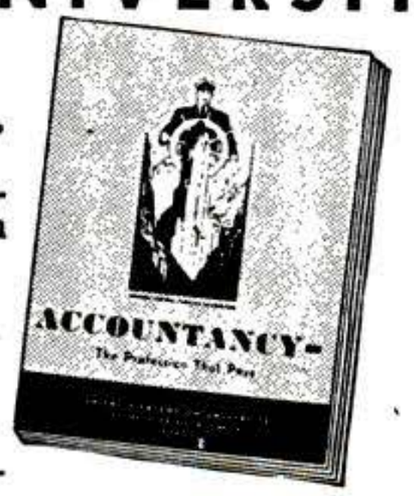

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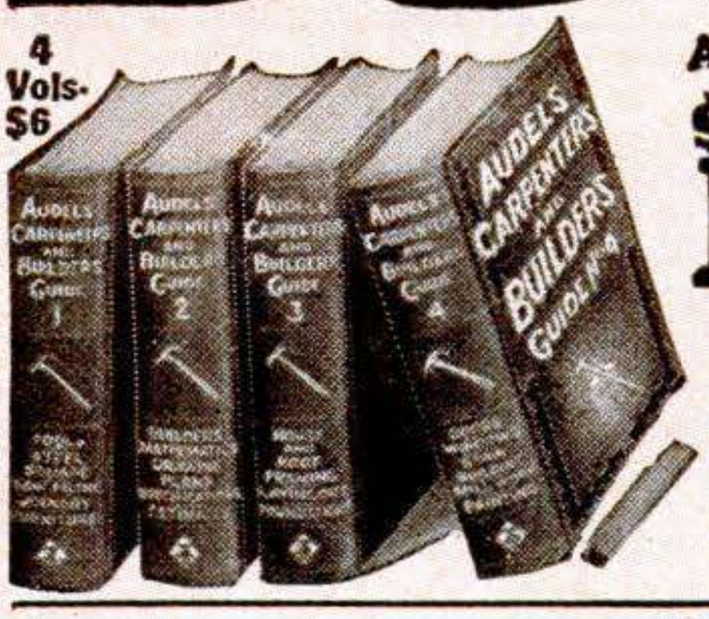

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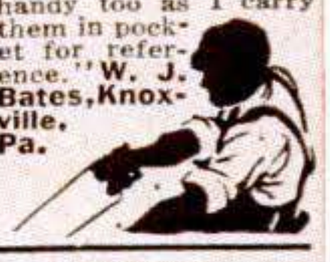

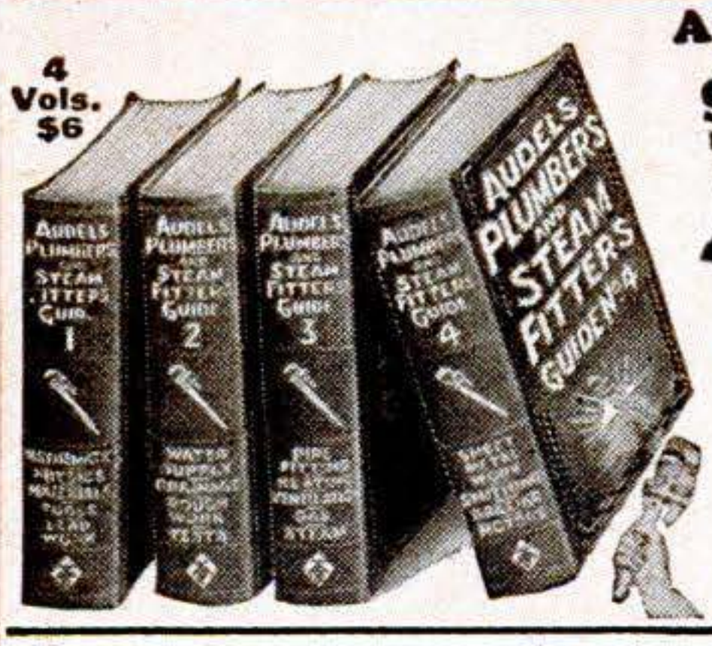

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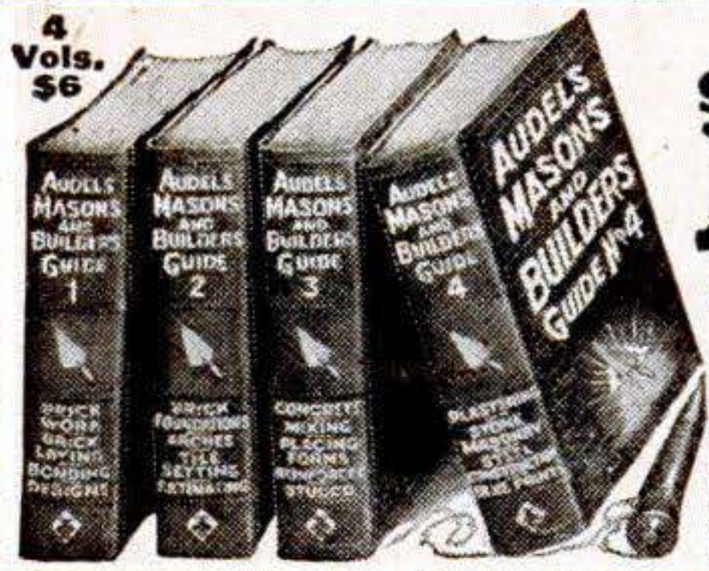

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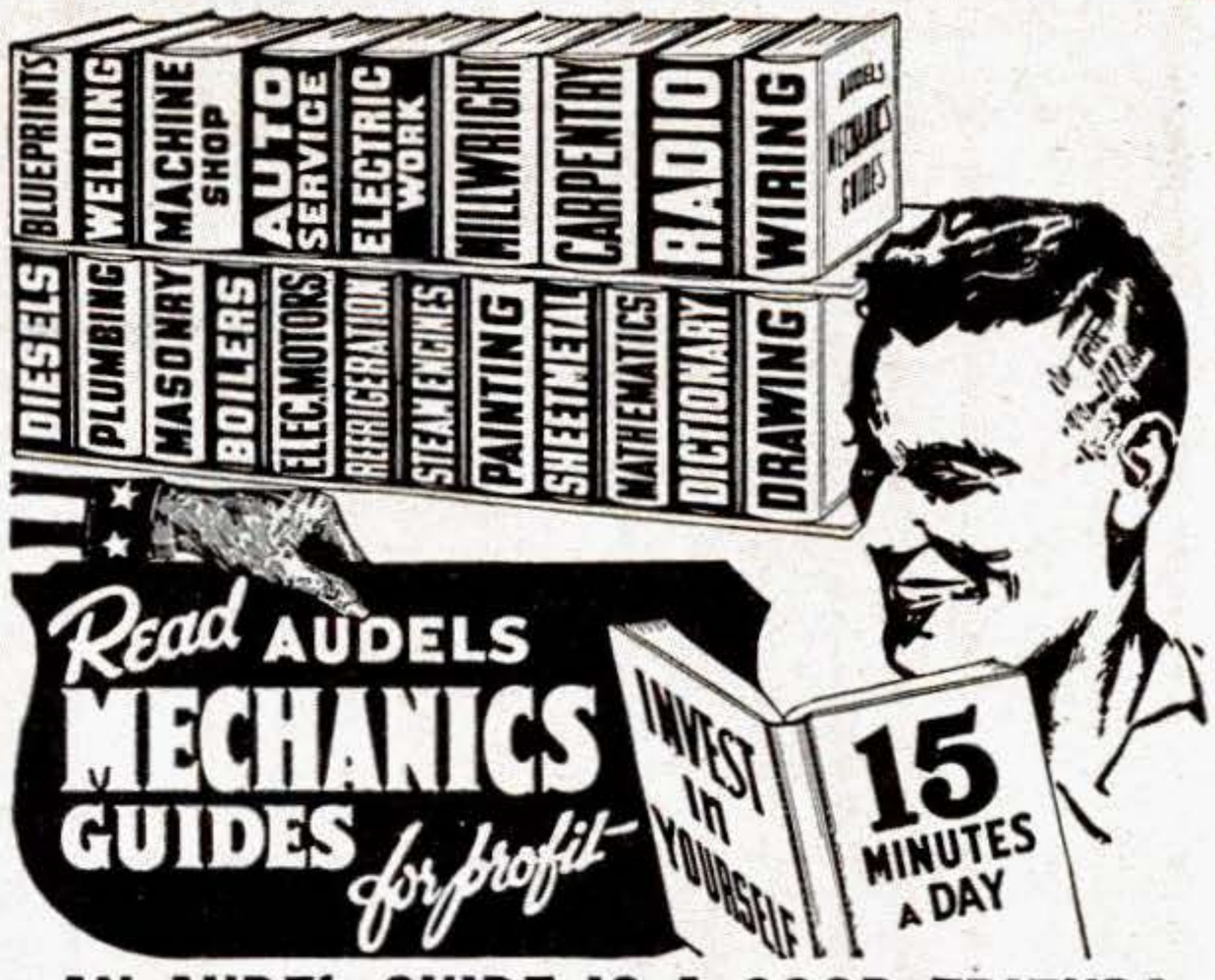

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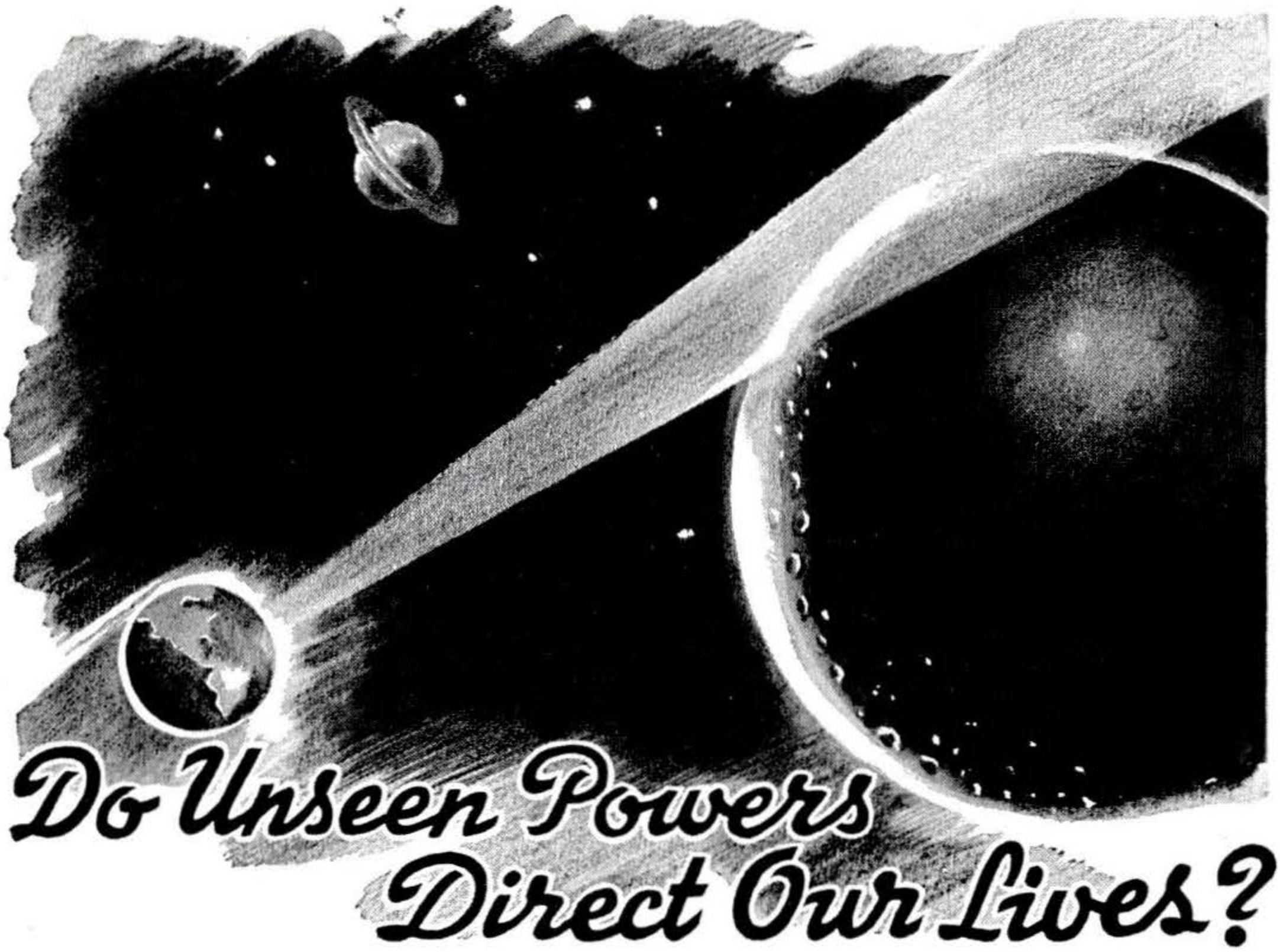

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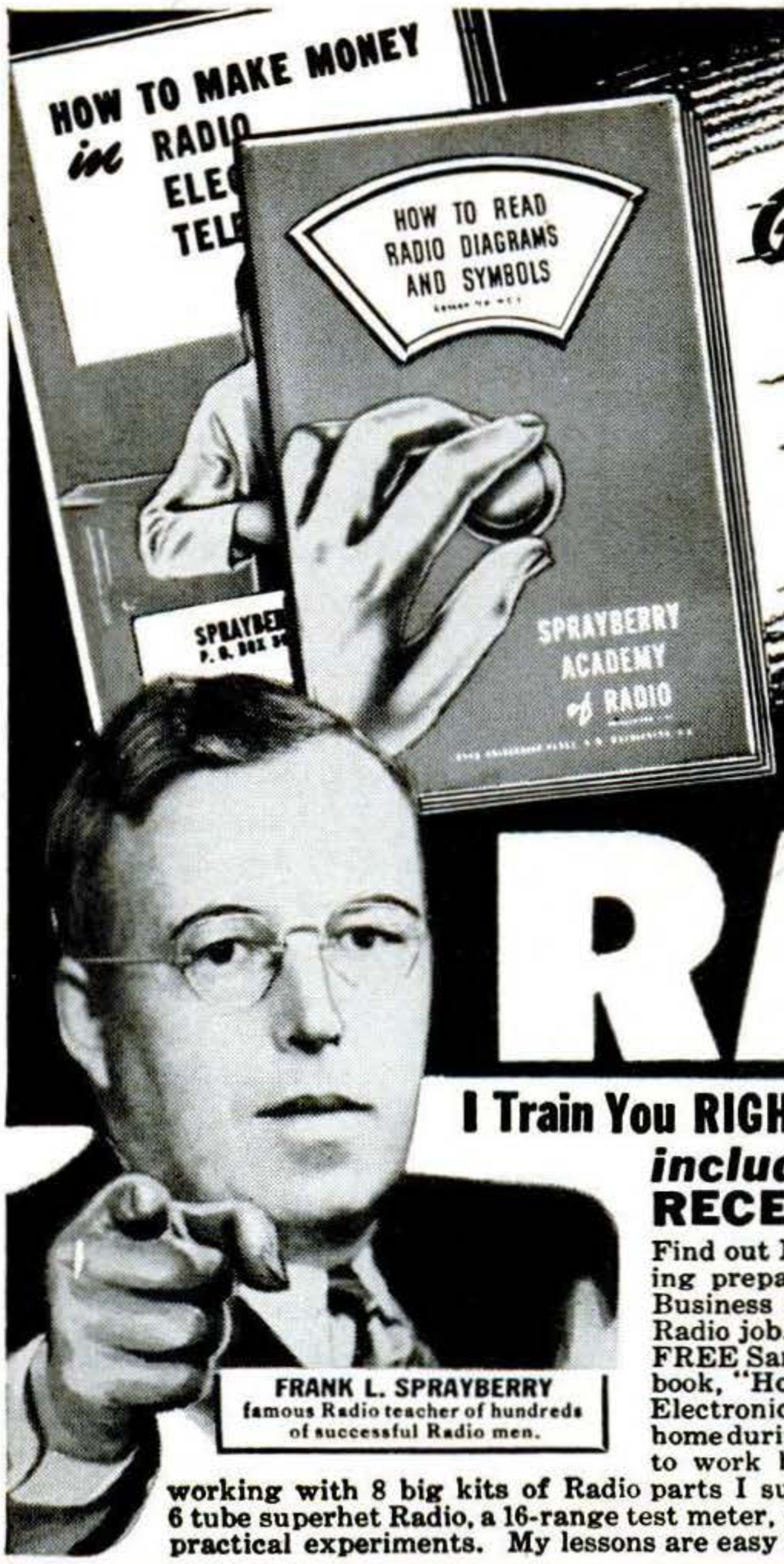

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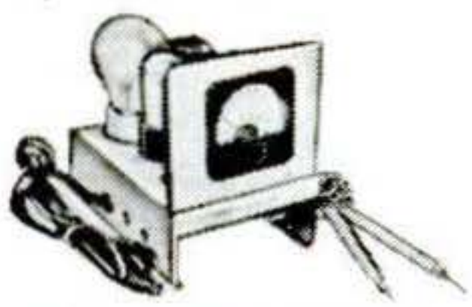

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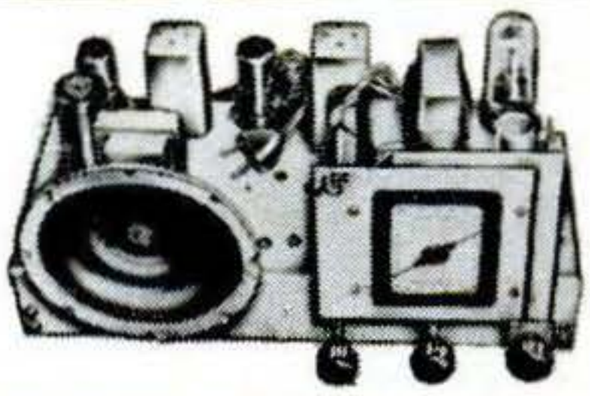

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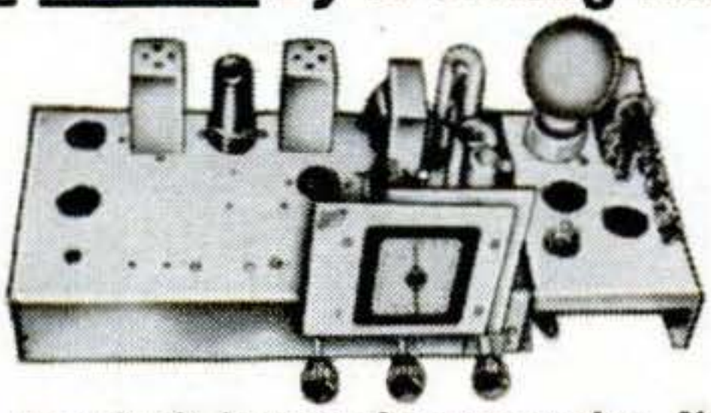

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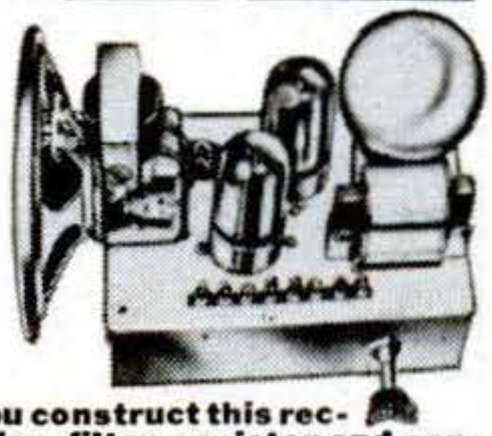

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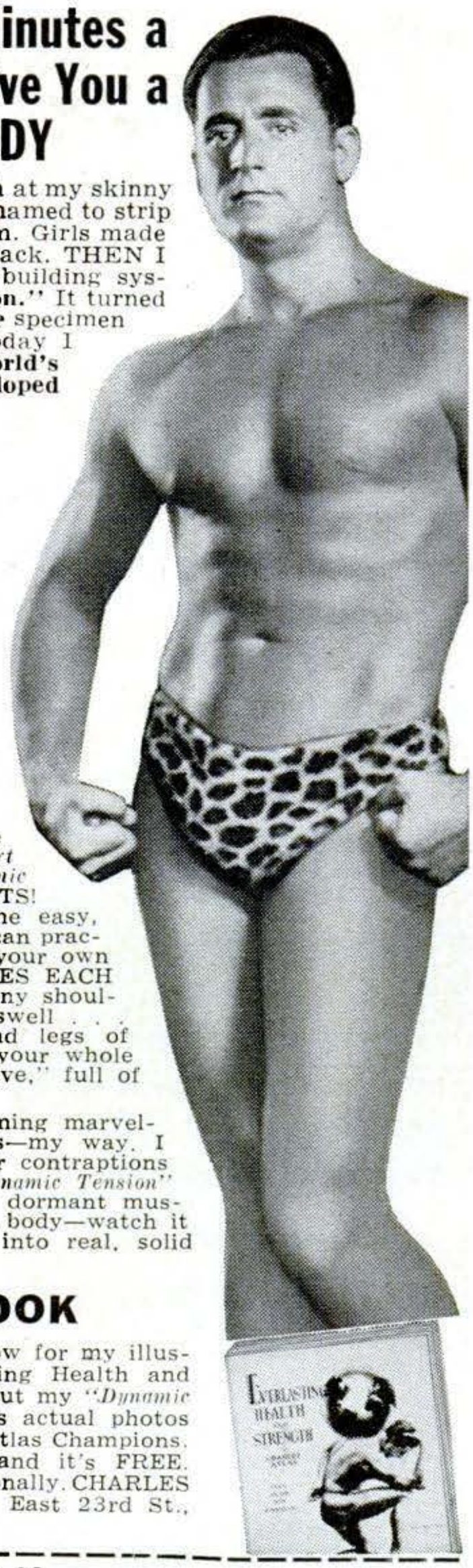

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Letters

How Jets Work

Sir:

In jet propulsion, is the plane driven through the air by the force of the jet exhaust pushing against the air or solely by the reaction of the expanding gas?

Will you also make clear, in layman's language, how jets and rockets can function in a vacuum?

JAMES NOVARRO

Seattle, Wash.

Jet and rocket planes are driven through the air because of Newton's Third Law of Motion: For every action there is an equal and opposite reaction. A good example of this reaction is the kick of a shotgun. If you fire a shotgun while sitting in a canoe, the canoe will move backwards—you have a rocket-propelled canoe. You wouldn't say the shotgun pellets "push against the air," and neither do jets or rockets.

Jets will not operate in a vacuum, but only because they need the oxygen of the air to oxidize or burn their fuel. Rockets carry their own oxidizers in chemical form, and these actually work better in a vacuum.

Word Trouble

Sir:

My interest in photomicrography prompts me to call your attention to page 177 of the January issue where the word "microphotograph" is used to mean "photomicrograph."

LAWRENCE LENEY

Jamesville, N. Y.

The dictionary gives microphotograph and photomicrograph as loosely interchangeable, but in the strict sense Mr. Leney is right. A photomicrograph is a photograph of an object taken through a microscope; a microphotograph is a very small photograph.

Wrong-Way PS

Sir:

In your November issue, you ran an article called "Homemade Slingshot Launches Plane" [p. 146]. In this article you state

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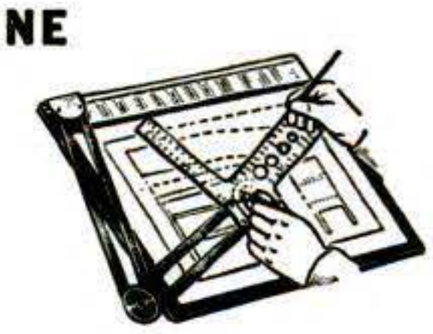

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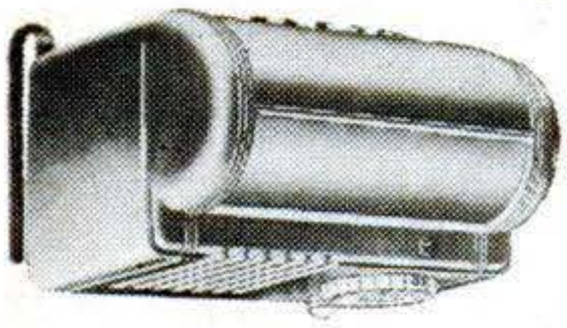

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that the plane always takes off up hill. Now I'll admit I don't know much about airplanes, but could you explain why he takes off up hill, when he uses a rubber shock cord to provide extra power for such a short runway?

RICHARD M. SCOTT

Cranbury, N. J.

The sentence was meant to read: "The plane always takes off from the uphill end of the field." In a last-minute bit of hurried editing the sentence—and the plane—got turned around.

Nothing New

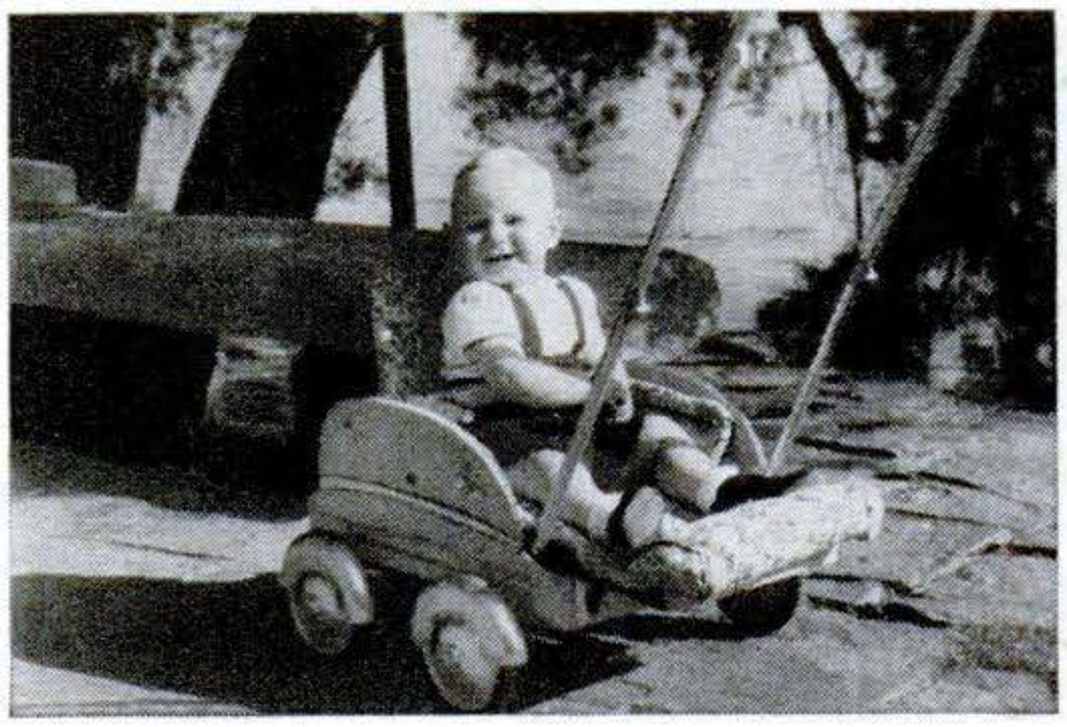
Sir:

In the October issue on page 166 I found the article "Baby Carriage Makes Suitcase."

As there is nothing new in the world, I send you a picture [below] of the "Dodo" portable baby carriage. The carriage can be folded together in 5 seconds and taken in the car or the railway as luggage. It is made in Switzerland. I bought such a carriage for my boy, as the picture shows.

HUGO MARTHALER

Lucerne, Switzerland



Chilly Problem

Sir:

In the January issue, on page 106, J. B. Morris tells how he connected a radio, tuned it in to a dead spot, and then shut the refrigerator door to discover if the light went out. He could have learned the same thing in two seconds by opening the door of the refrigerator and touching the small switch in the door jamb. . . .

MABEL KRAUSHAAR

Woodmere, N. Y.

Sir:

. . . Use a 3-way socket and a short cord with a socket for a bulb. Take the cord out-

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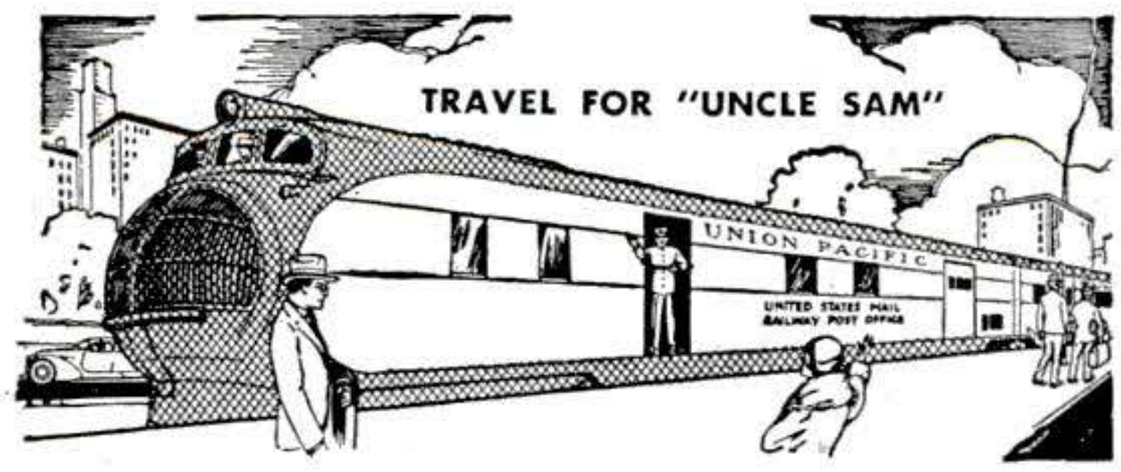

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side the refrigerator and close the door. If the light goes out on the outside, the inside one is out, too. . . .

ROBERT JONES

Augusta, Me.

Sir:

. . . Simply open the refrigerator door and feel the light bulb; if warm, the bulb was burning after the door was closed; if cold, the bulb had been out. . . .

L. ROBERT SNYDER

Littlestown, Pa.

Jet Cockpit

Sir:

Your December issue (p. 113: "How Jet Jockeys are Made") says the jet cockpit is simple compared to that of a piston-engined plane.

Jets are simpler as far as power controls are concerned. The jet does not have propeller-pitch and mixture controls. Engine instrumentation, however, is not simpler. The manifold-pressure gauge and the coolant-temperature gauge have been replaced by tailpipe- and bearing-temperature indicators. A jet still has the fuel-pressure, oil-pressure, and oil-temperature gauges.

All in all, I do not agree that jet cockpits are simpler.

E. W. WOOD

Atlanta, Ga.

We'll concede that you say more precisely what we meant. The jet's instrument panel is crammed with indicators (as our picture showed), but its pilot doesn't have to operate as many controls as in a propellered plane. Consensus of fighter pilots is that the jet is, therefore, simpler to fly.

High Compression

Sir:

I enjoyed your articles on the new 1949 Cadillac and Oldsmobile high compression engines, but why didn't you mention the leader in the high compression field—Crosley with its 7.8 to 1 compression ratio?

BILLY MEEKS

Texarkana, Texas

Reader Meeks is right—as of today. At the time the Cadillac and Oldsmobile articles were written, however, the Crosley's higher compression had not been officially an-

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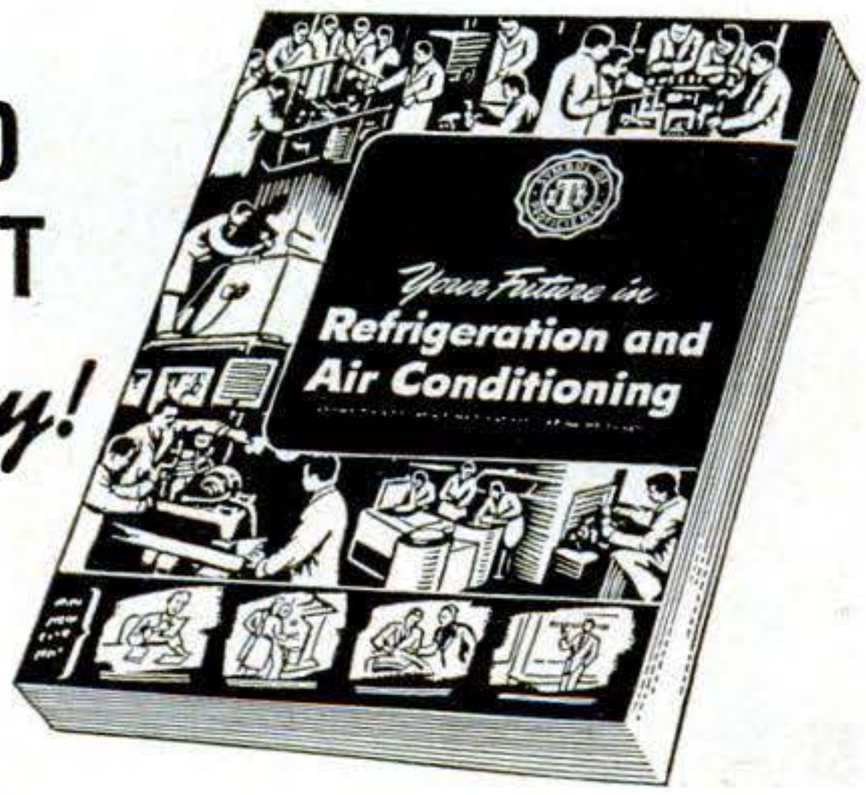

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nounced. Crosley has been given proper credit in this issue on page 185.

Space Flying

Sir:

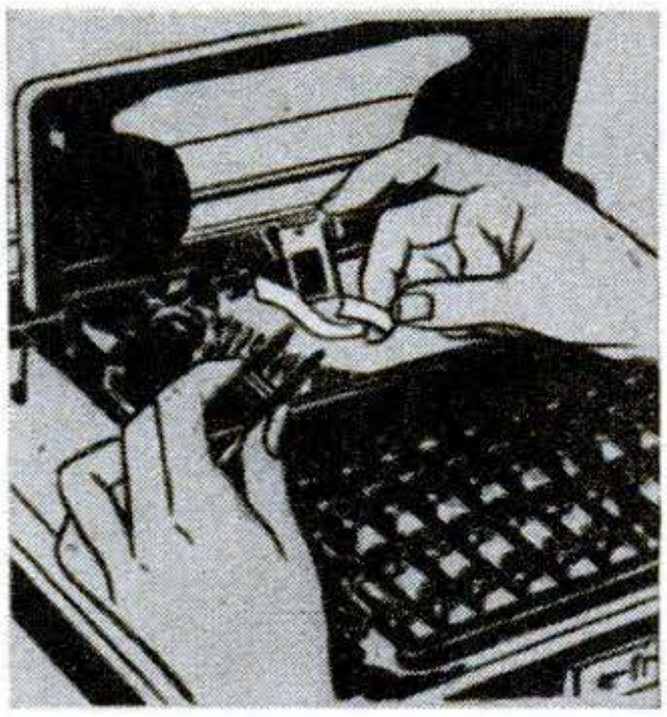
In "Riding the Ramjet" (January, p. 131), the final paragraph states: "flight into space beyond the earth, . . . by rocket . . . or ramjet." How can a ramjet work in space?

CLARKE BLAIR

Hagaman, N. Y.

You apparently missed this statement in the same article: "Since there is no air in outer space and the ramjet could no longer function, it could then be turned off. Then there would be a period of free coasting until reverse booster rockets were turned on to decelerate for a lunar landing."

No Sooner Said than Done



Sir:

In the January issue [p. 173], you mentioned a new idea in typewriter ribbons [inkless leaders on the ribbon ends, shown above at left]. Our new ribbon [above at right] has a clean silver end which will not soil the secretary's fingers. . . .

B. A. DEMING

The Carter's Ink Co.
Chicago, Ill.

Ferris Wheel Parks Cars

Sir:

In your Nov. 1948 issue (p. 122-123) you show an auto parking idea. Why not have large Ferris wheels with platforms in place of seats big enough to hold one auto each? Think what a small ground space would be taken. And even if your car is on top, there'd be no trouble in getting it.

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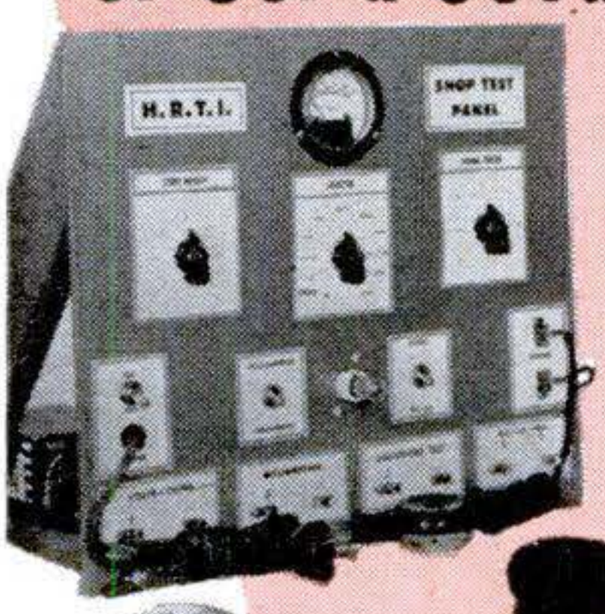

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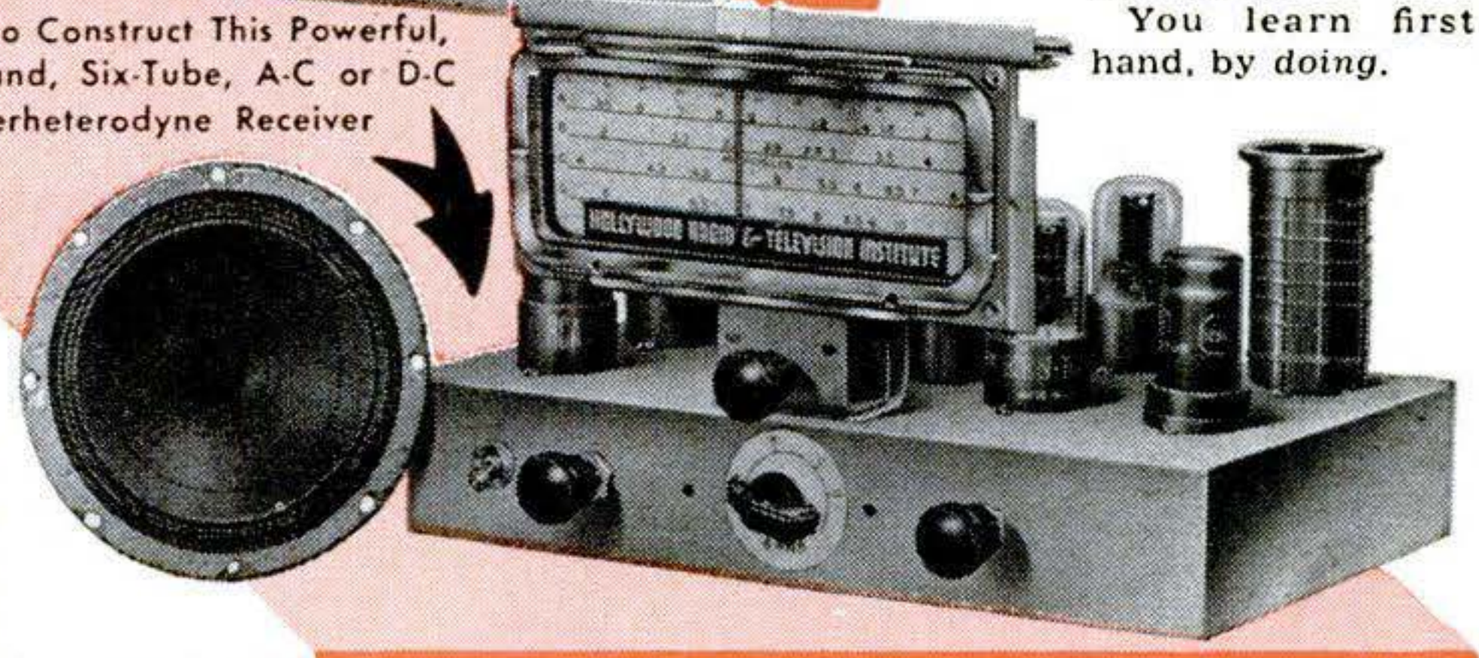

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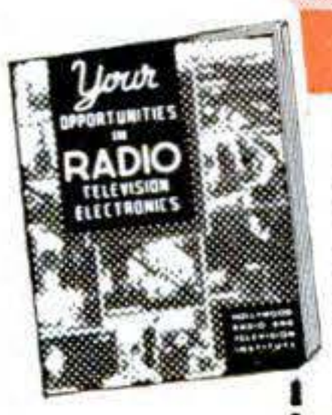

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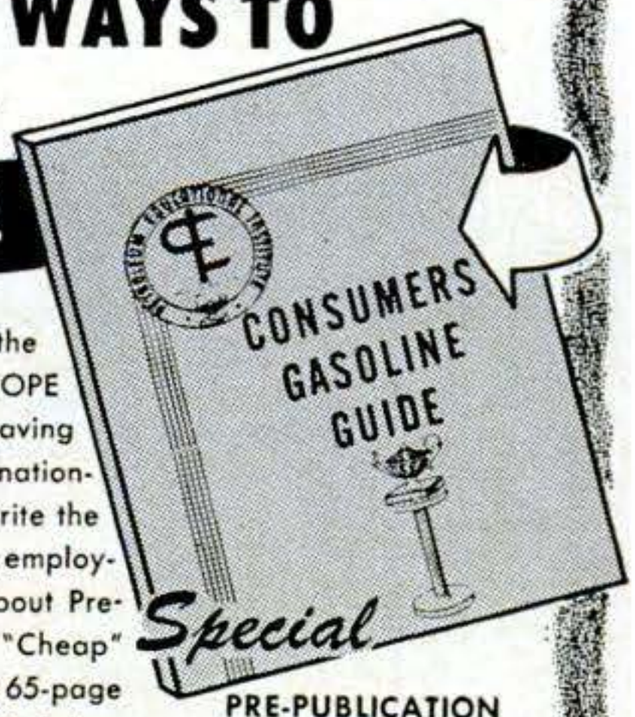

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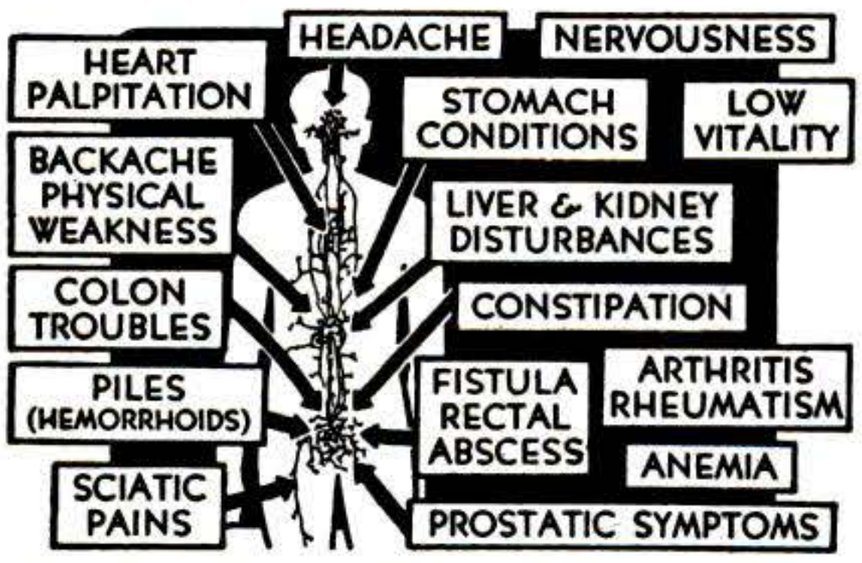

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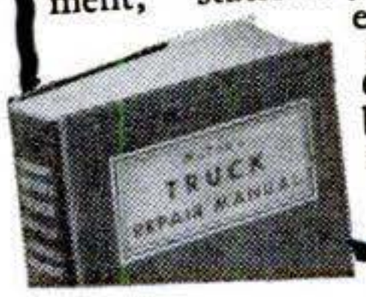

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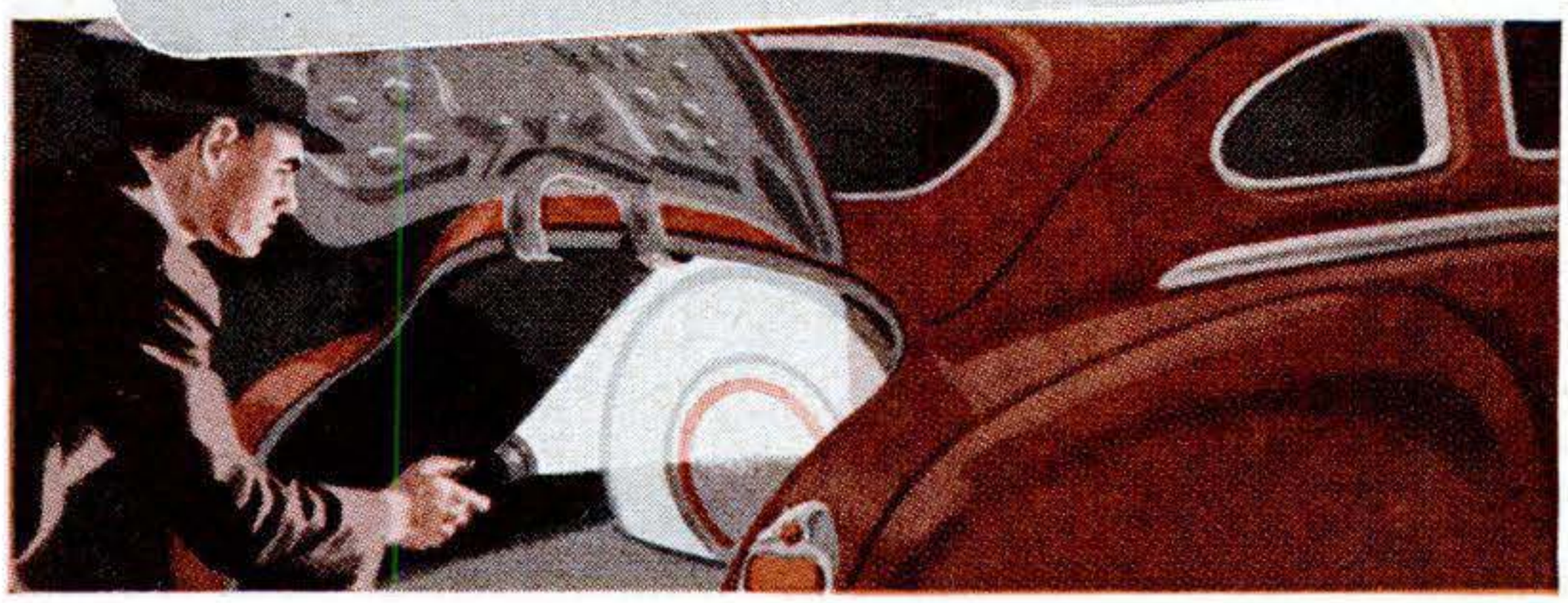
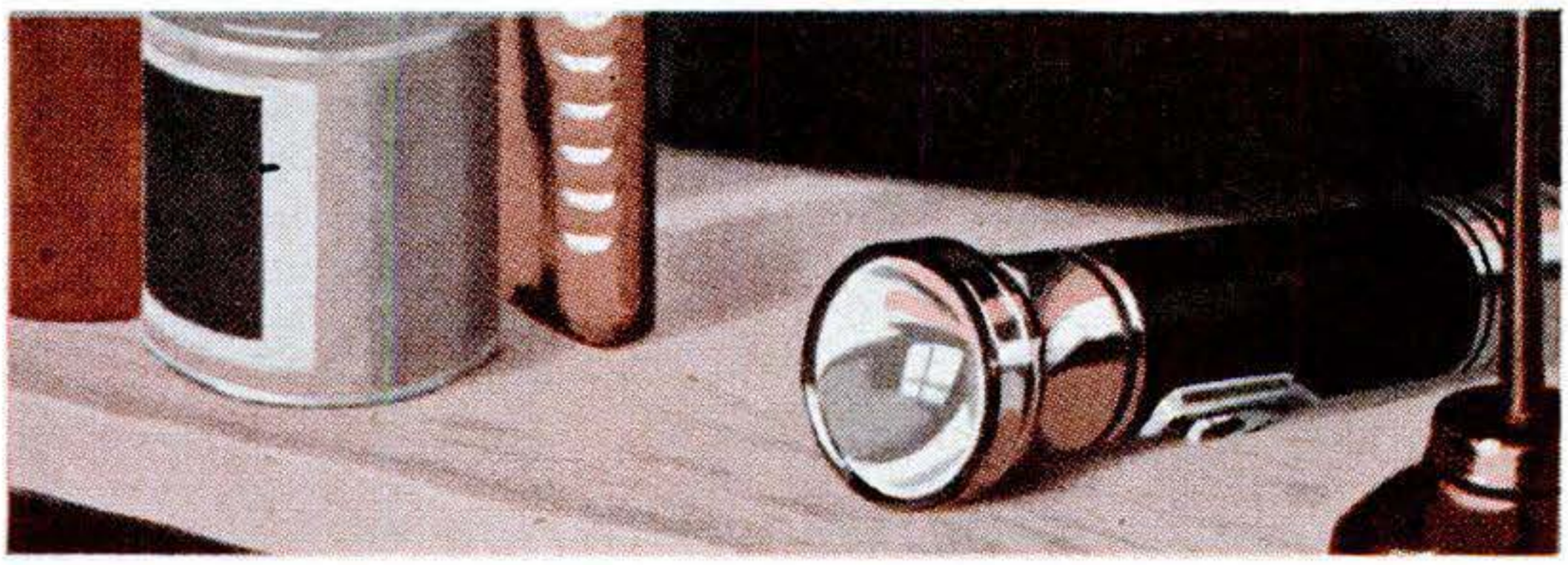
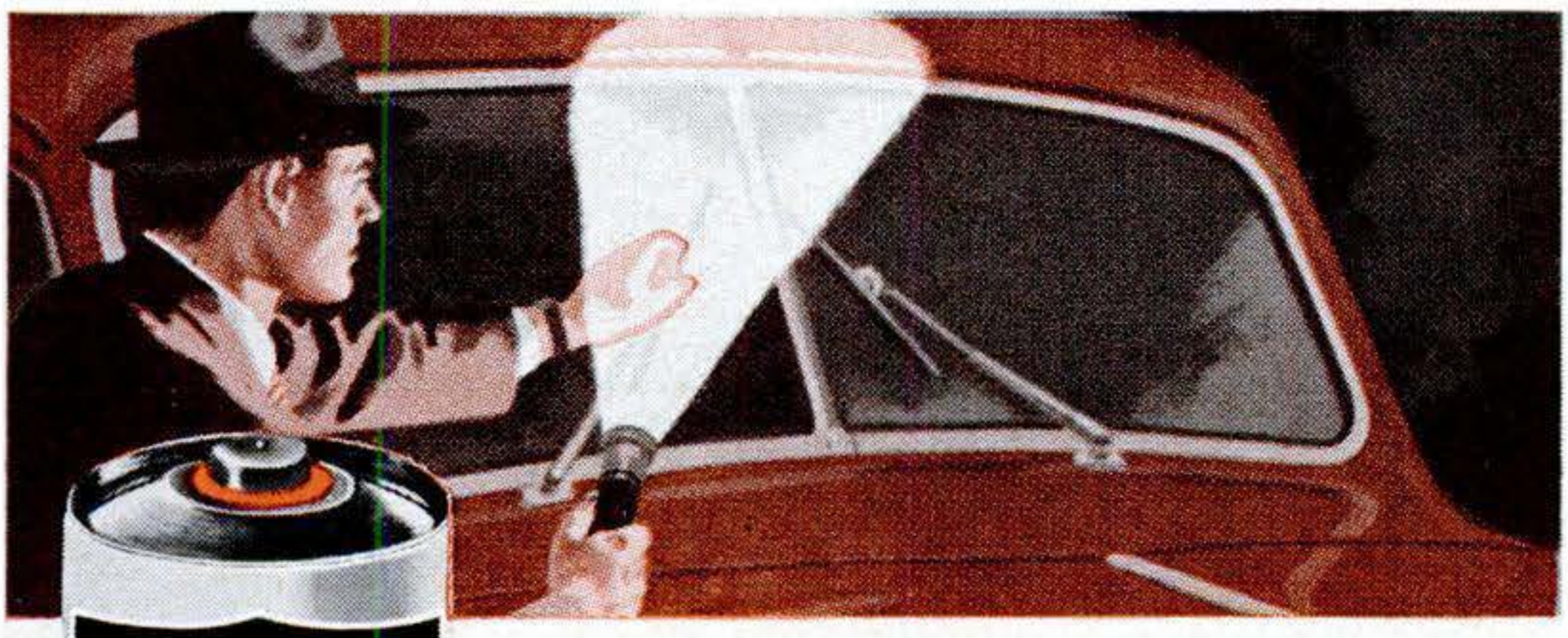


Just as an active cat...



takes a cat nap and...



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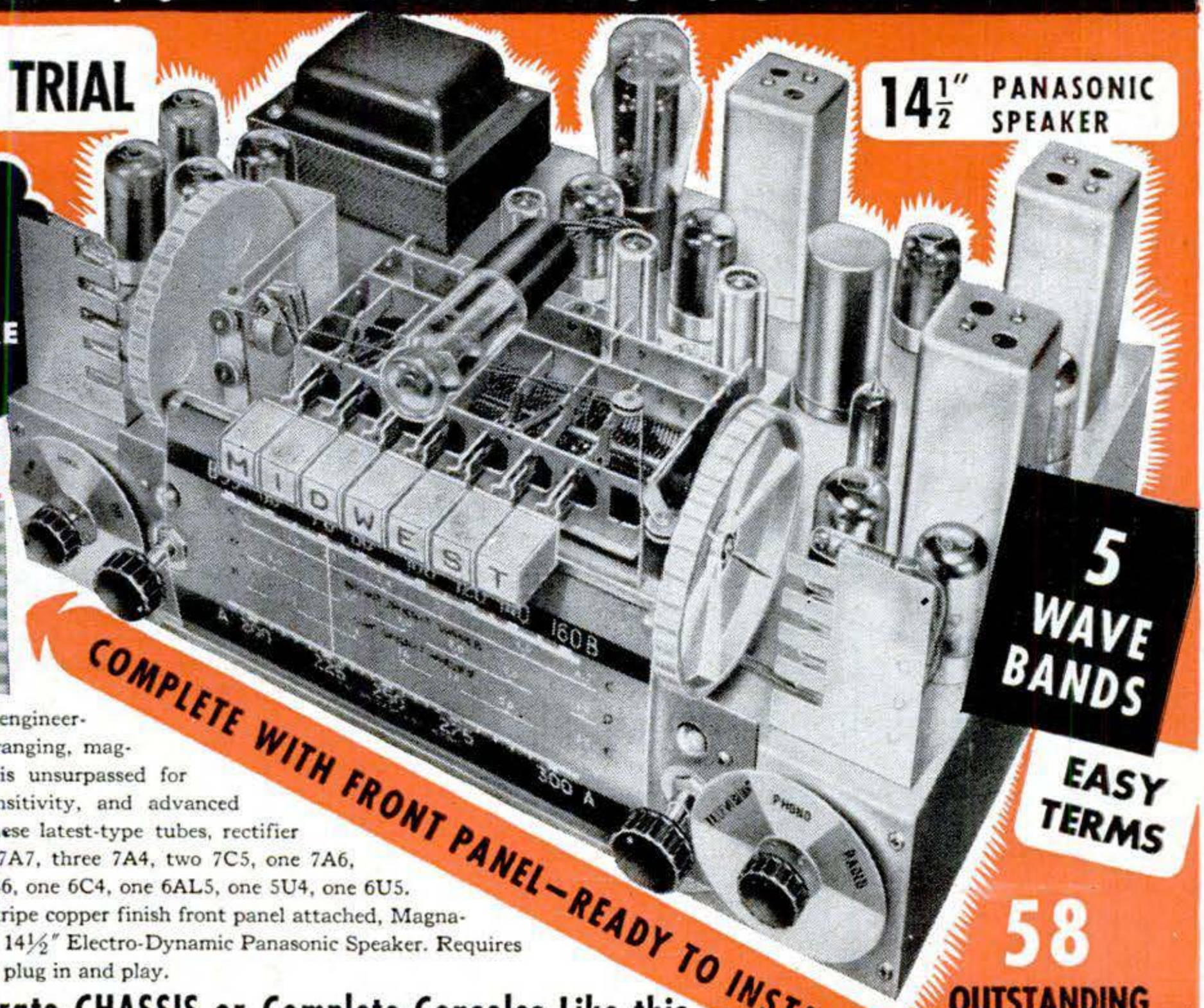

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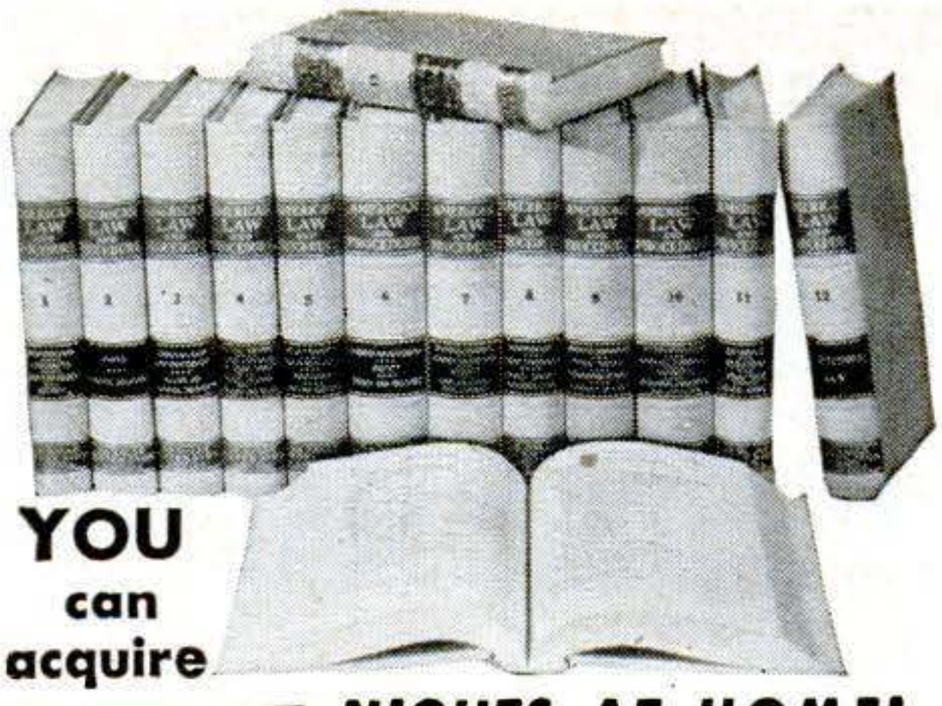

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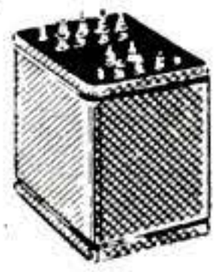

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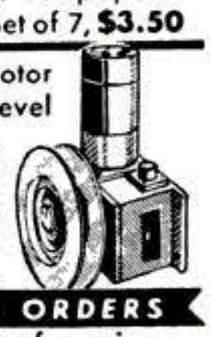

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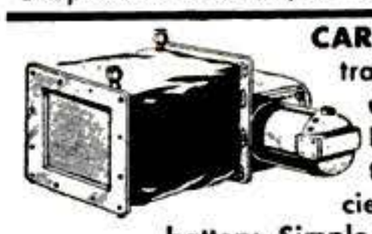

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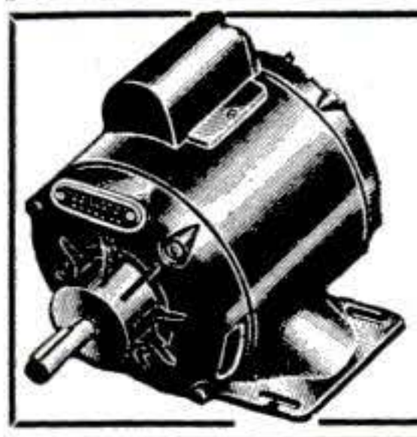

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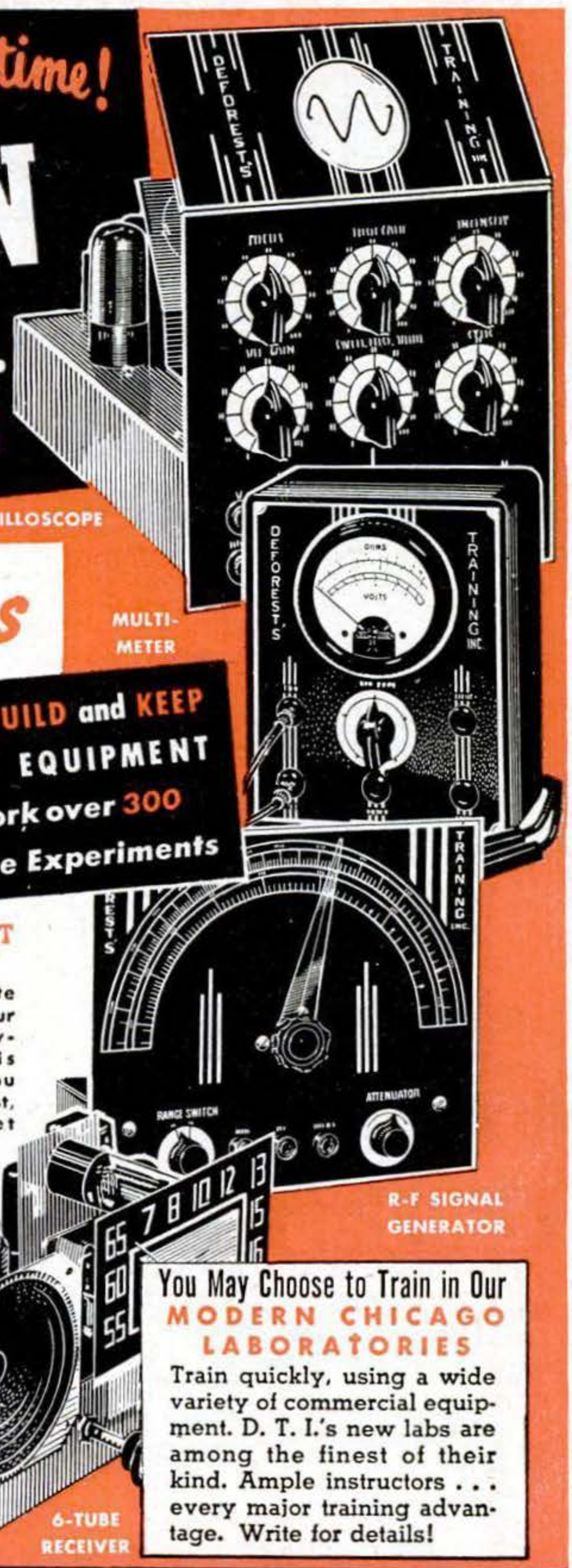

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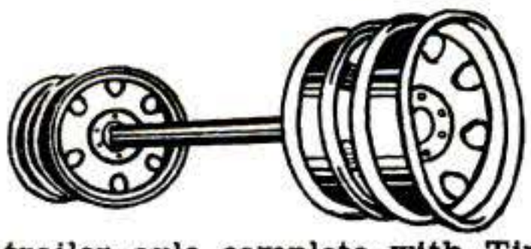

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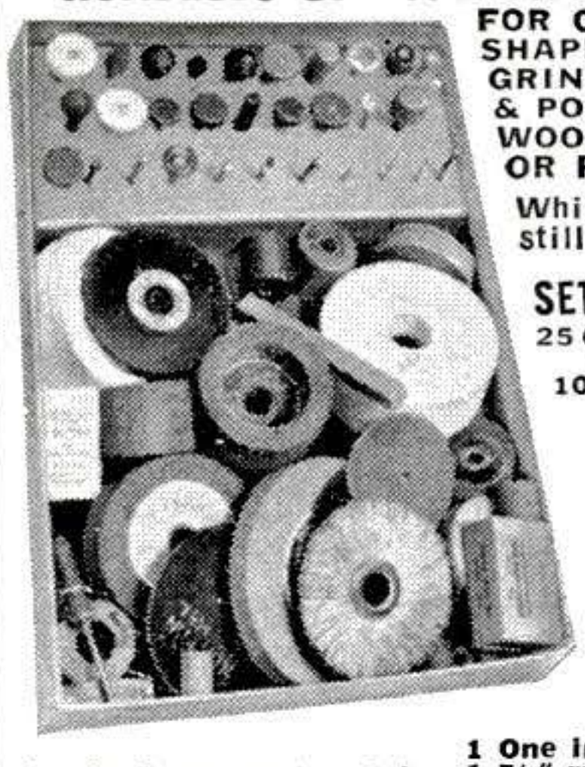

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10 Sanding rolls
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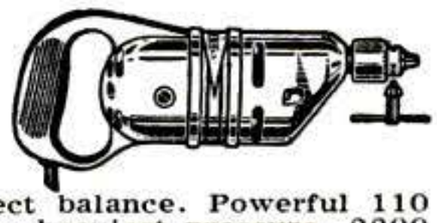

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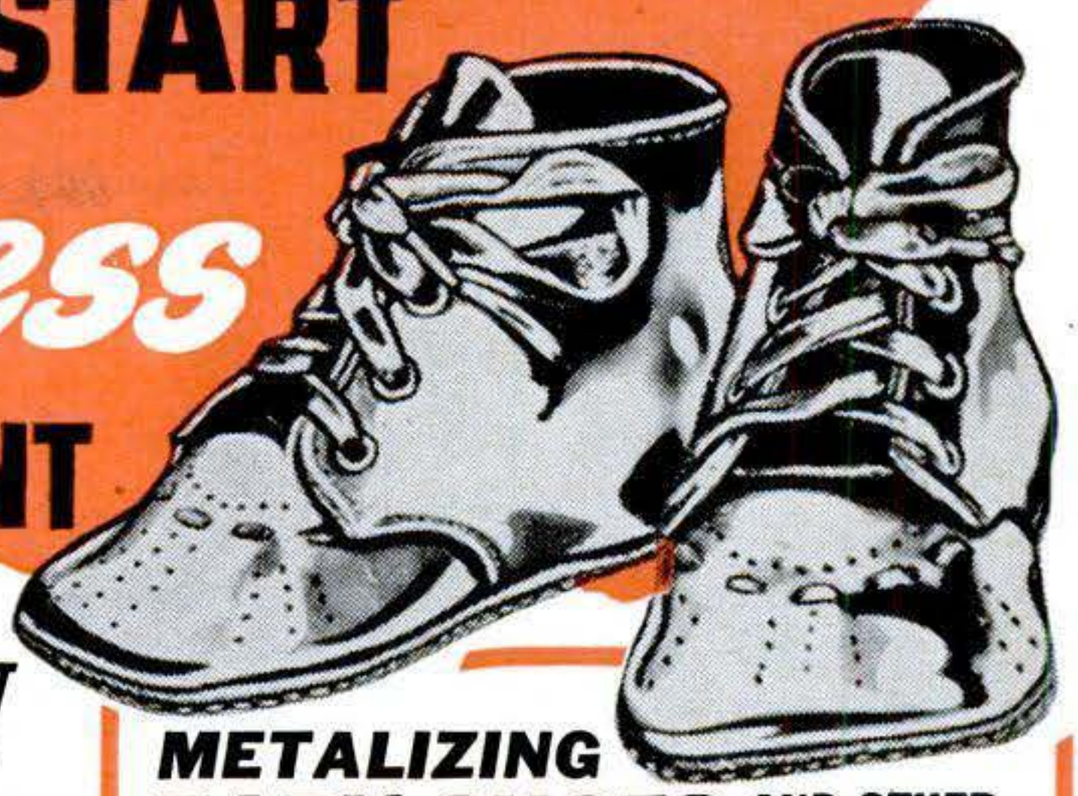


WARNER SUCCESS PLAN
Gives exact instructions showing you

● How to start in spare time ● How to use home as headquarters ● How to bring in the business ● How to do real METALIZING in genuine GOLD, SILVER, or BRONZE, by the easy Warner Method ● How to start without risking your job ● How to pyramid your profits ● How to be sure of steady, big income.

Don't turn this page until you've given serious thought to your future. In the uncertain years ahead, the men who own their businesses are the ones who will be happiest. A small start now easily can lead you to complete independence, freedom from time clocks, freedom from fear of lay-offs, freedom from the limits of a pay check.

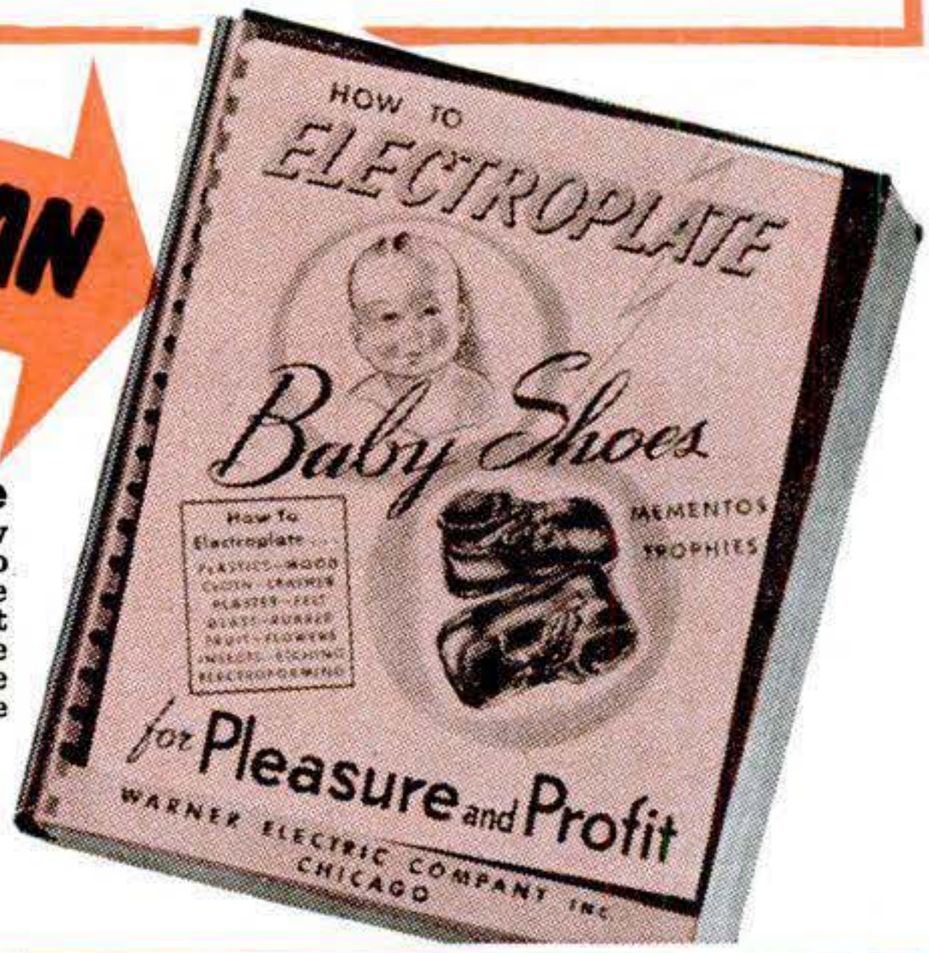
Now, while you can do it without risk—now is the time to investigate the exceptional opportunity offered you by the Warner Success Plan. Looking into the market, checking up on the possibilities for big sales and big profits will not cost you anything. Isn't this the time to lay the foundation for a future of complete independence — a life of happiness —a steady, dependable income?

METALIZING BABY SHOES AND OTHER KEEPSAKES

offers an exciting new opportunity to men or couples who want personal independence

If you'd like the feeling of being boss instead of being bossed — the Baby Shoe business is made to order for you. Just think of the appeal. A mother's love for her child — her desire to preserve forever the tiny shoes in which her baby took its first toddling steps. No wonder orders come easy and fast. No wonder profits are big. Then think of the Future. Fifteen Million babies in the last five years—three million last year—millions more next year. As long as babies are born, this business will prosper—in good times or bad. Think of the fun. Every job is different, interesting. And when you deliver a job and collect the money, you get a tremendous glow of satisfaction out of the mother's happy exclamations over your work. There's not another business I know of that offers you such big rewards in cash, in security, in a future, in independence that can be started on such a shoestring. You'll be glad you saw this ad—IF YOU SEND THE FREE COUPON.

READ THE ENTIRE PLAN
7 DAYS AT MY RISK



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This is one of the most fascinating businesses you can imagine. There are 15 MILLION pair of baby shoes waiting right now to be METALIZED. The opportunities are unlimited. The future is very big. And it's a business in which the whole family can have fun helping. A perfect business for man and wife to start—or for two partners. And I want you to read the whole Plan at my risk. Don't spend a cent unless you go ahead.

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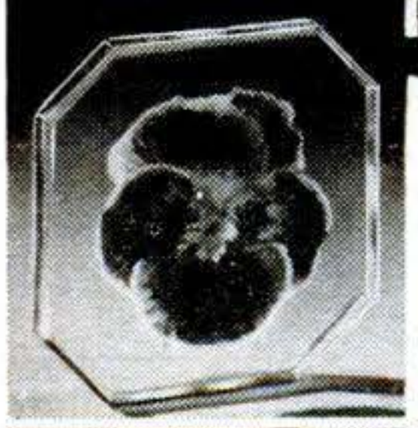

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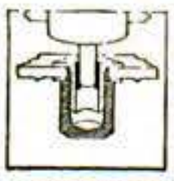

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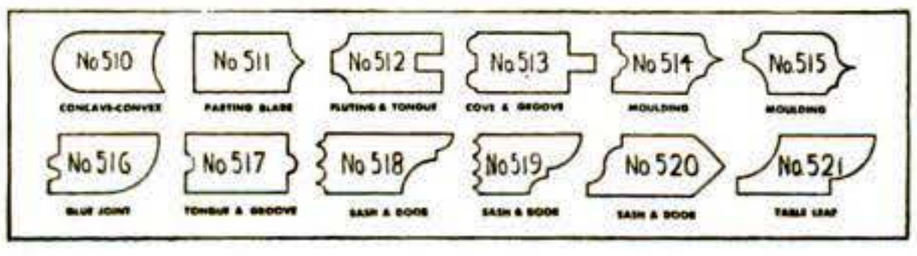

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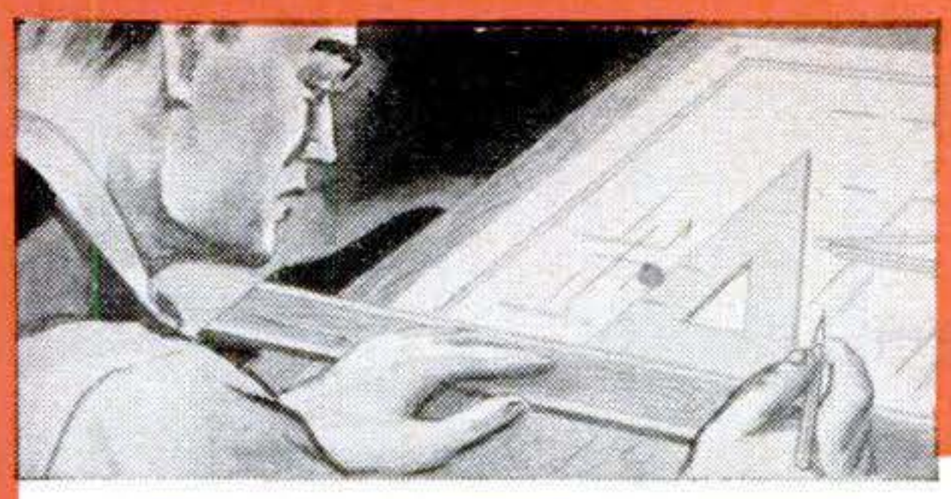

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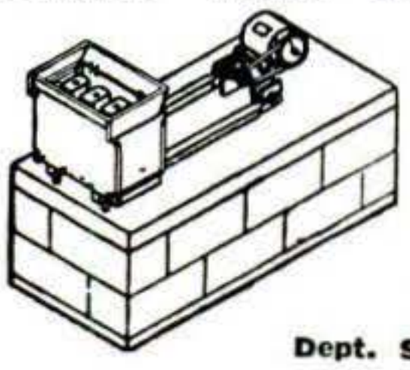

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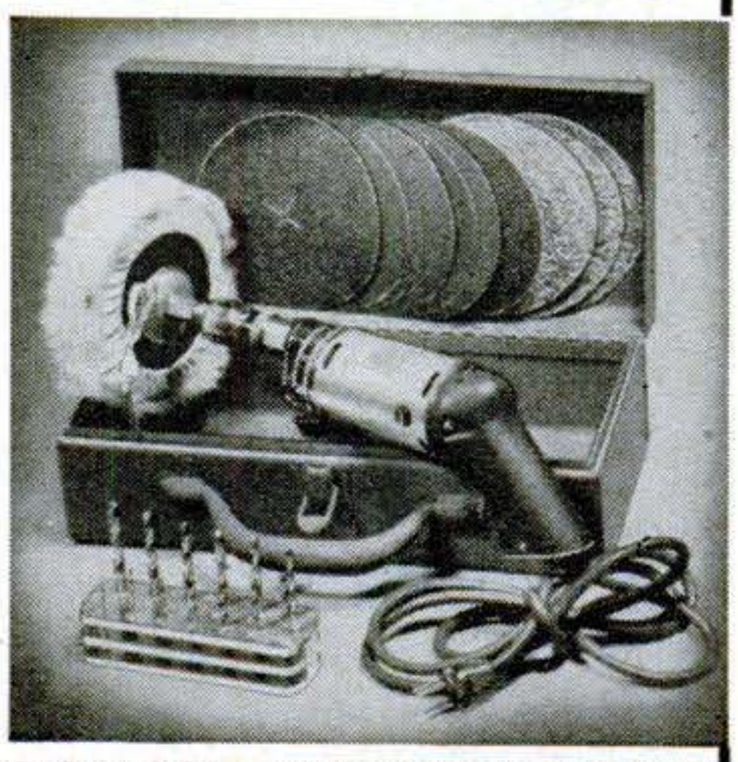

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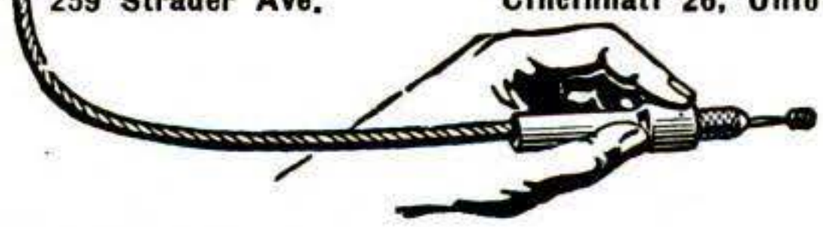

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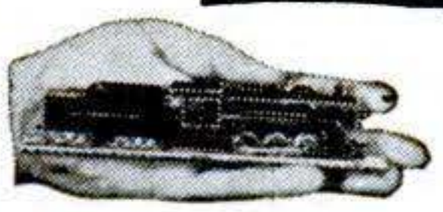

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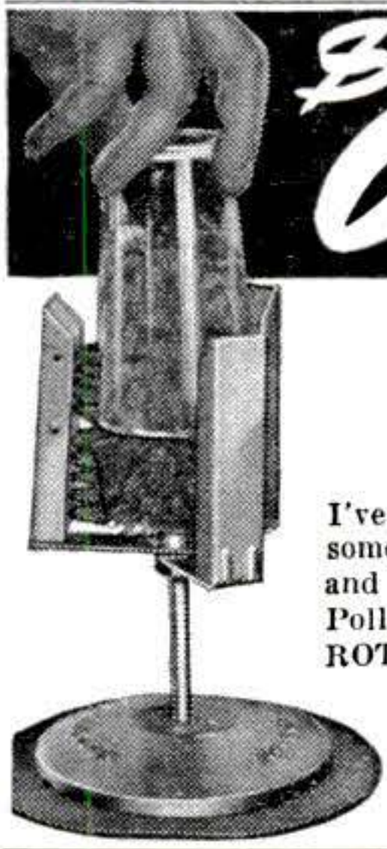

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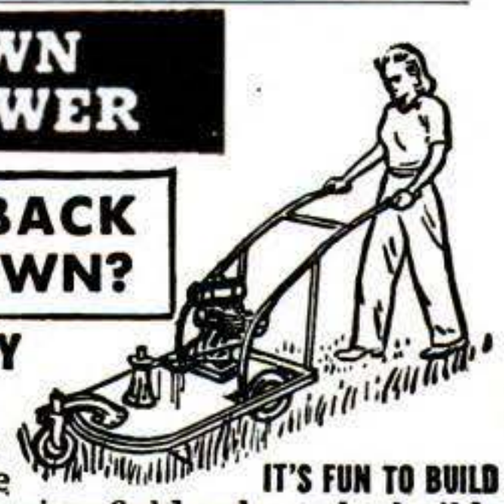

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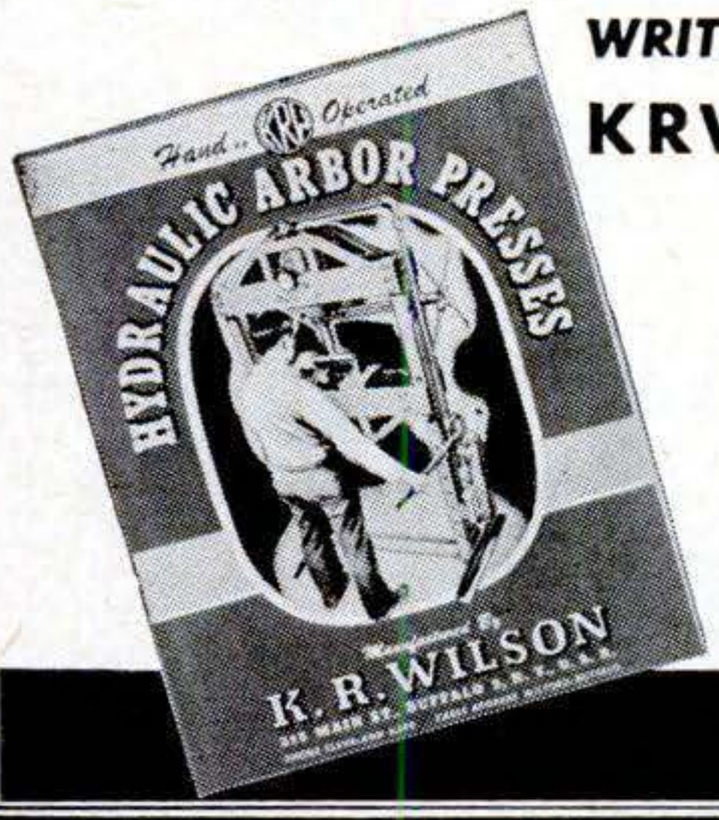

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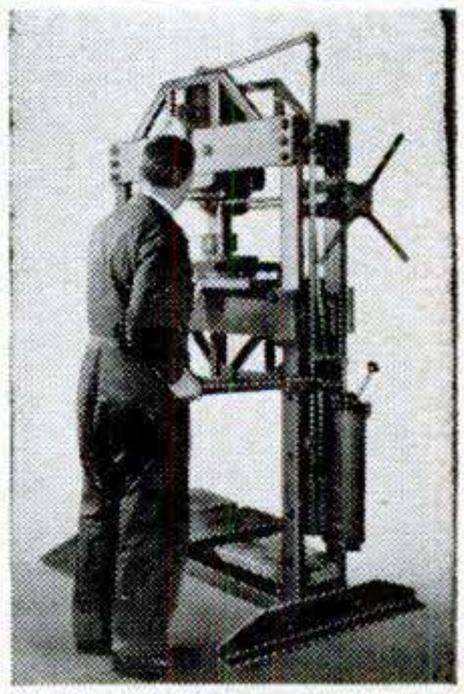

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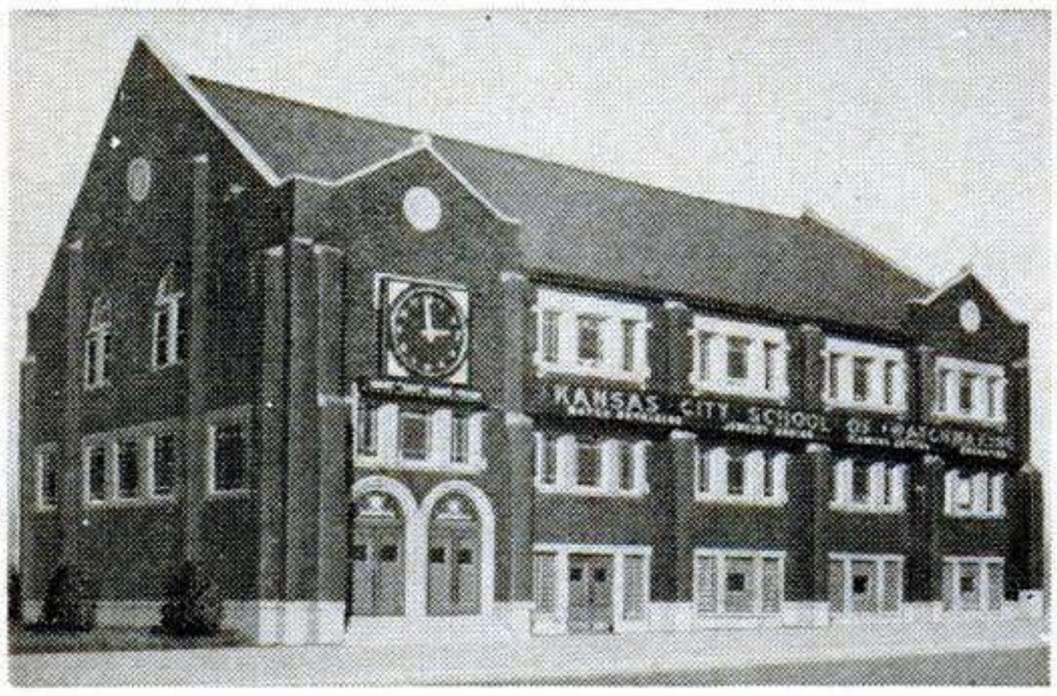

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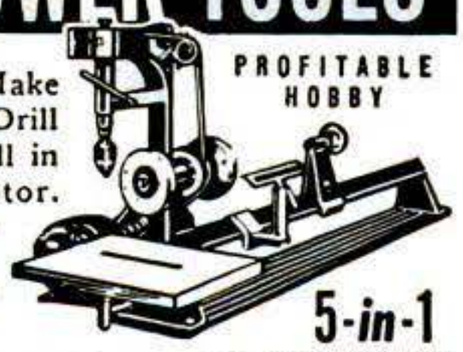

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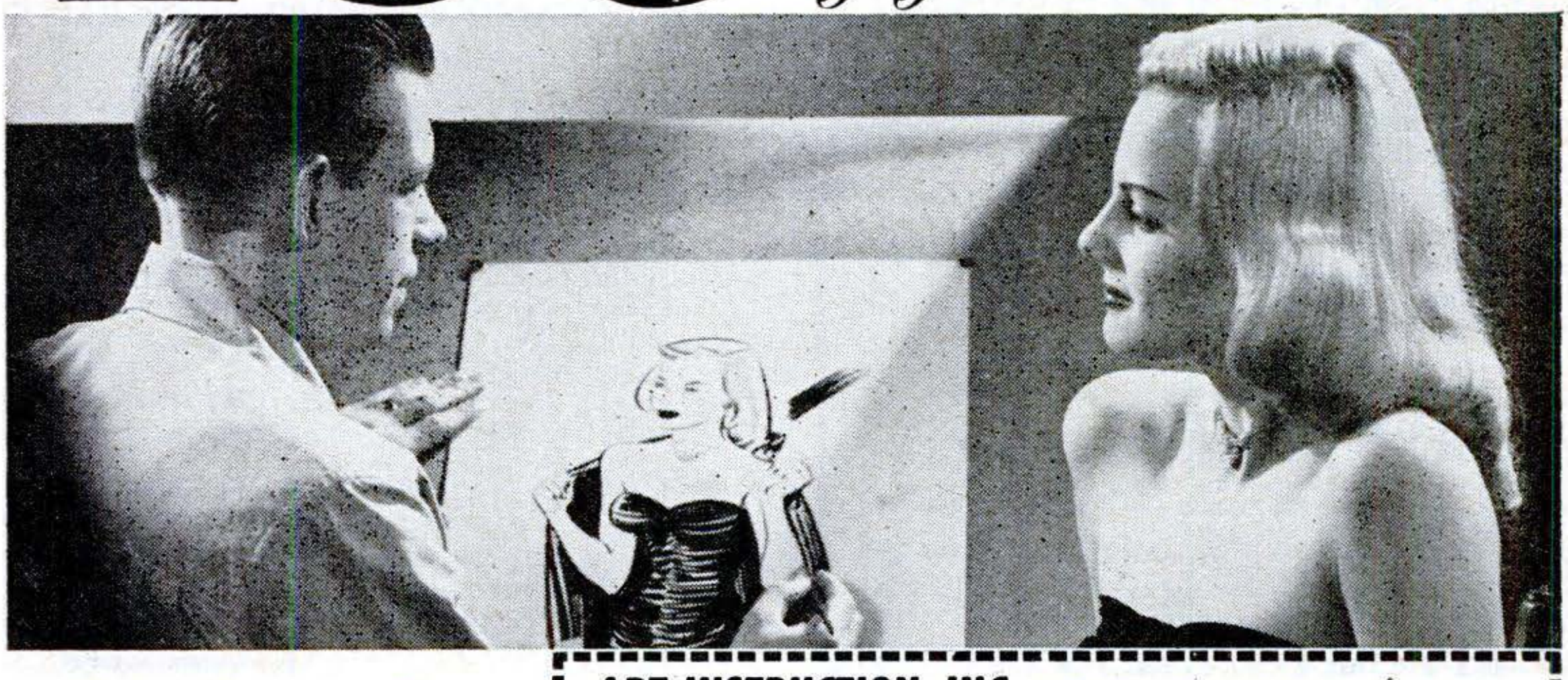

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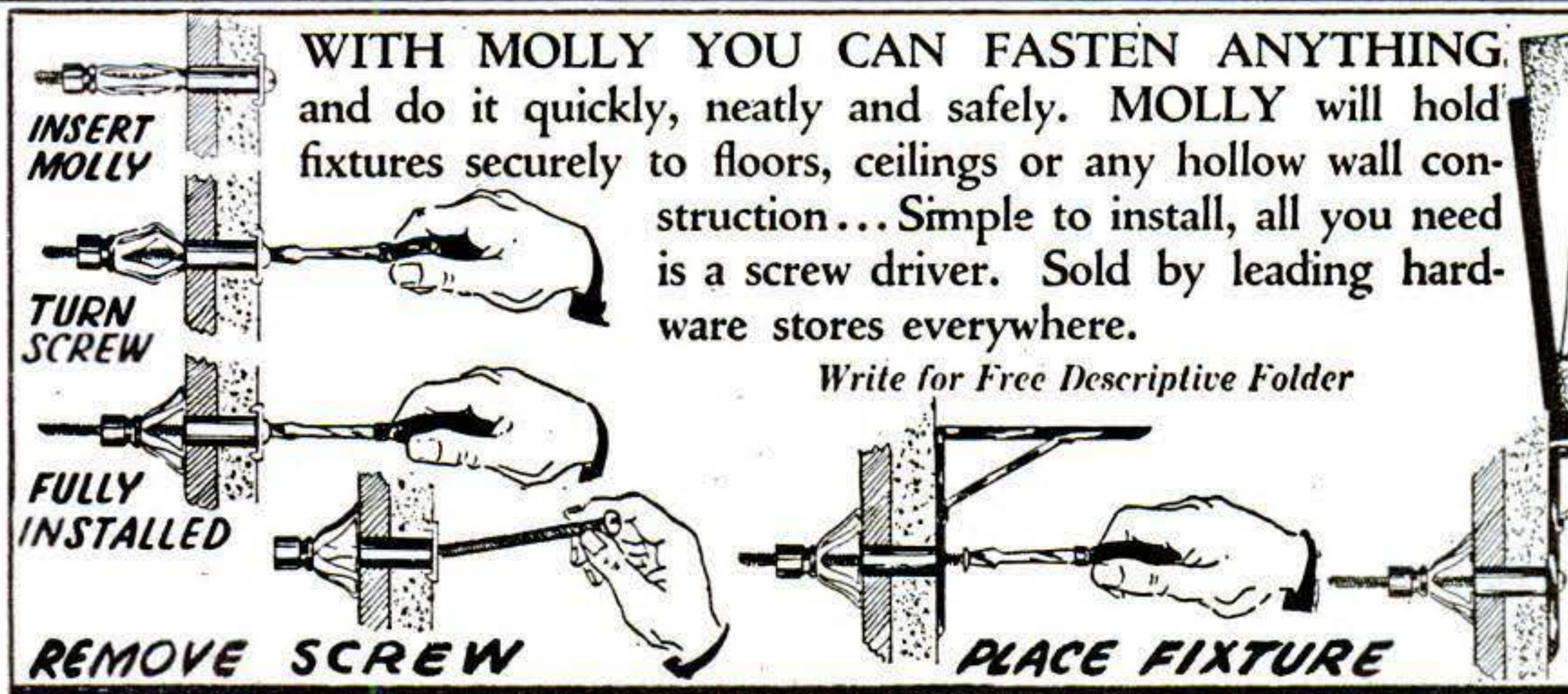

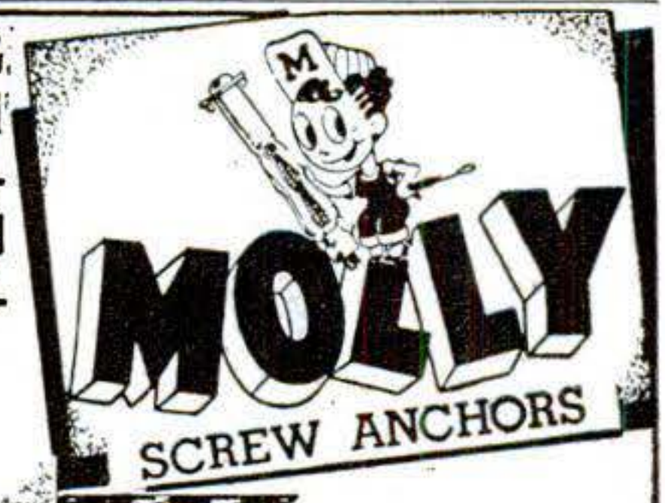

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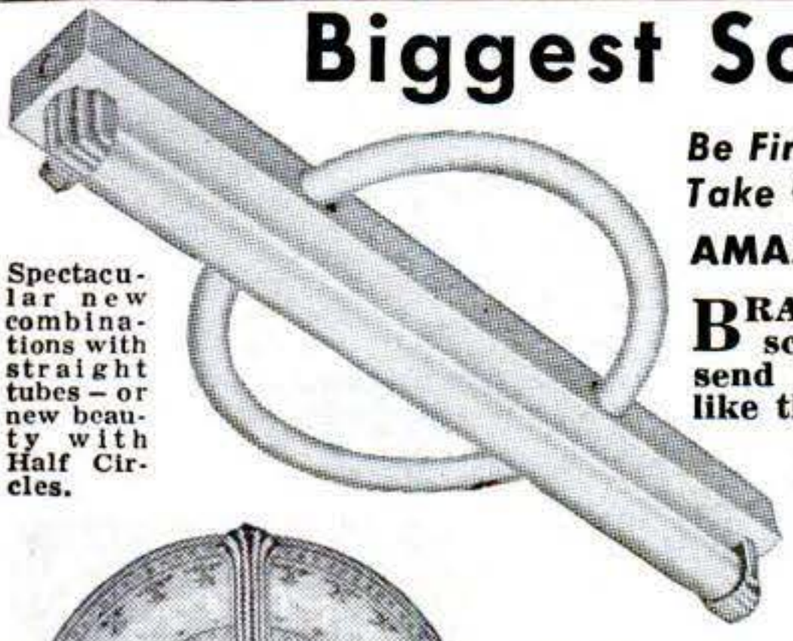

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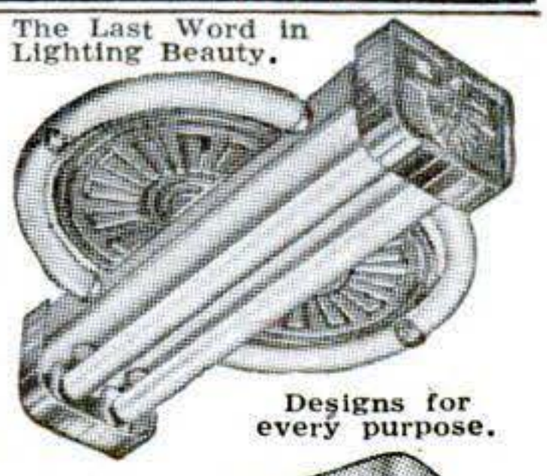

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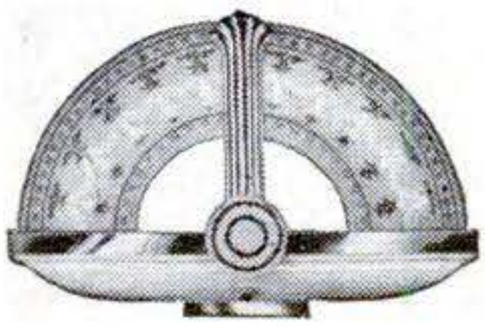

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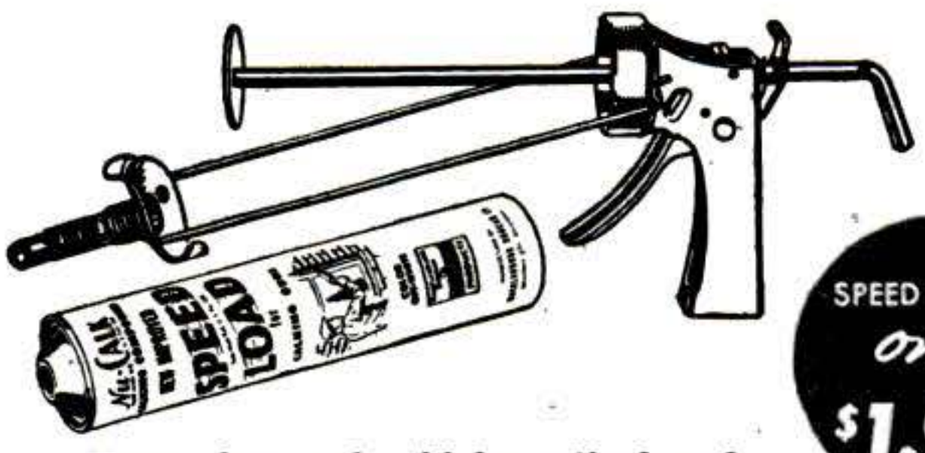

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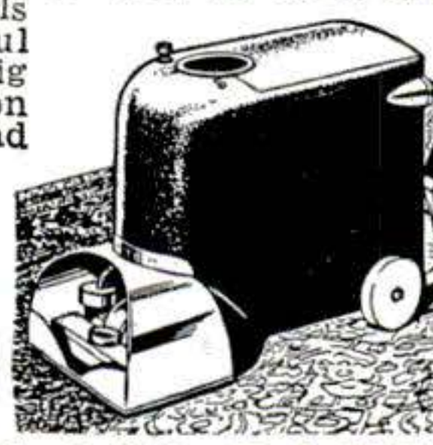

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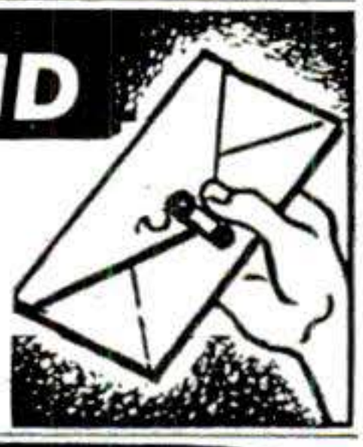

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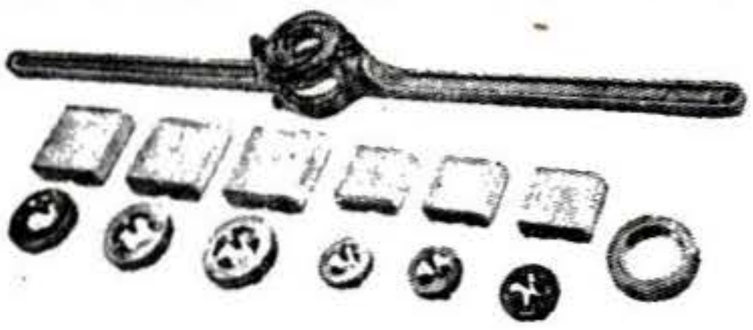

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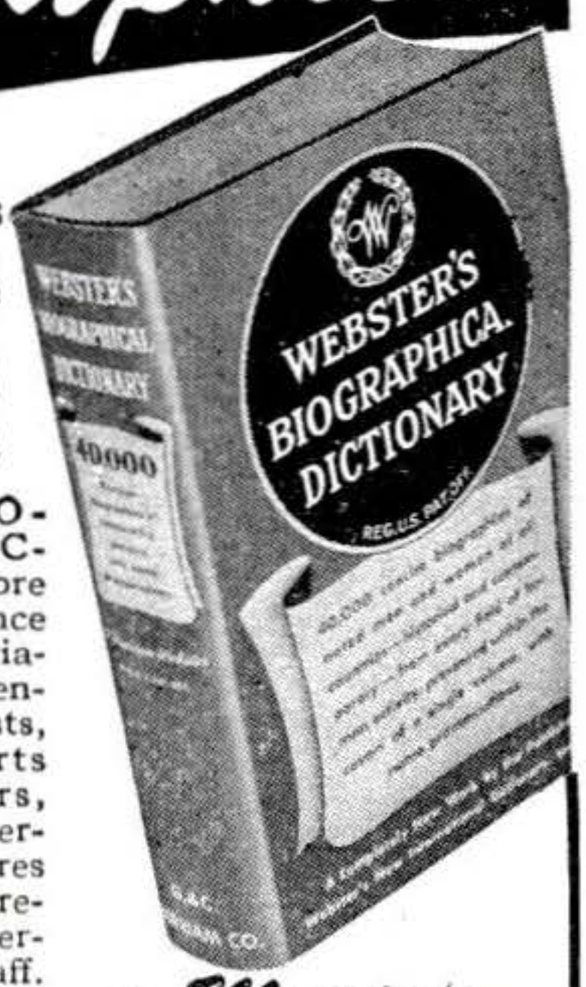

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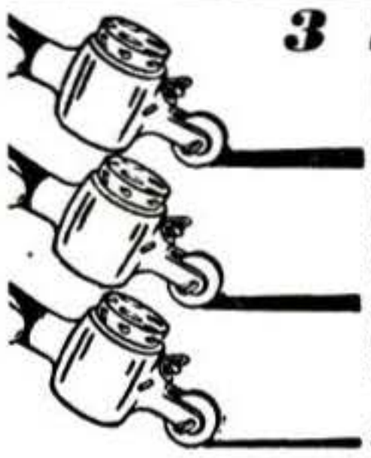

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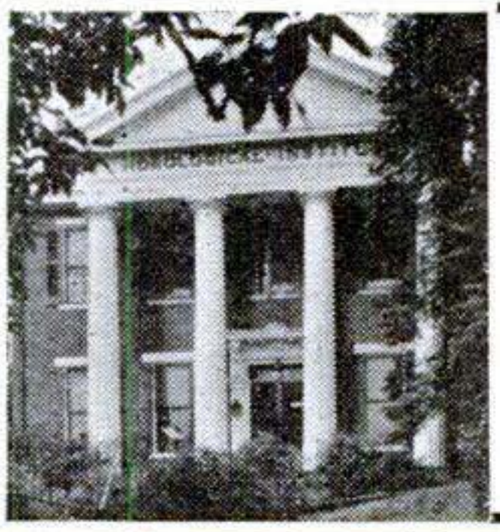

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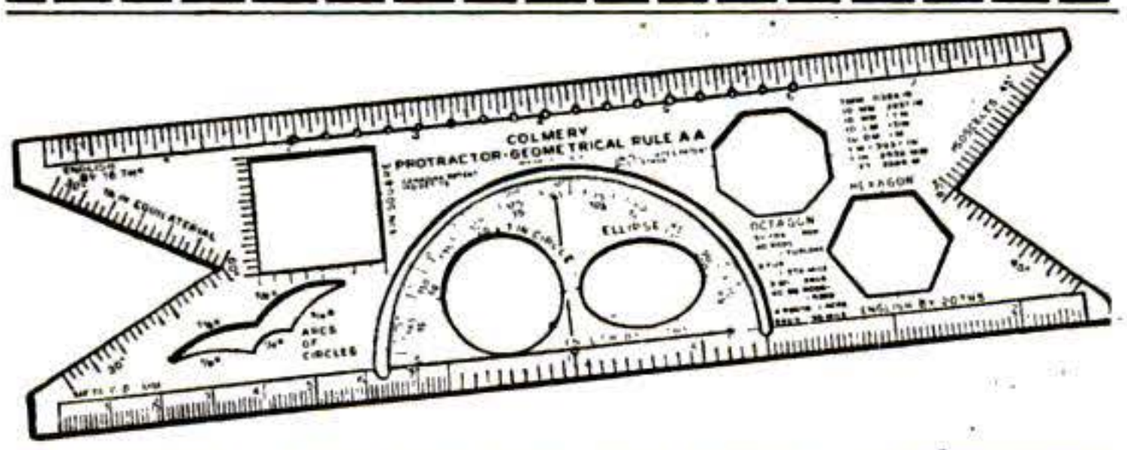

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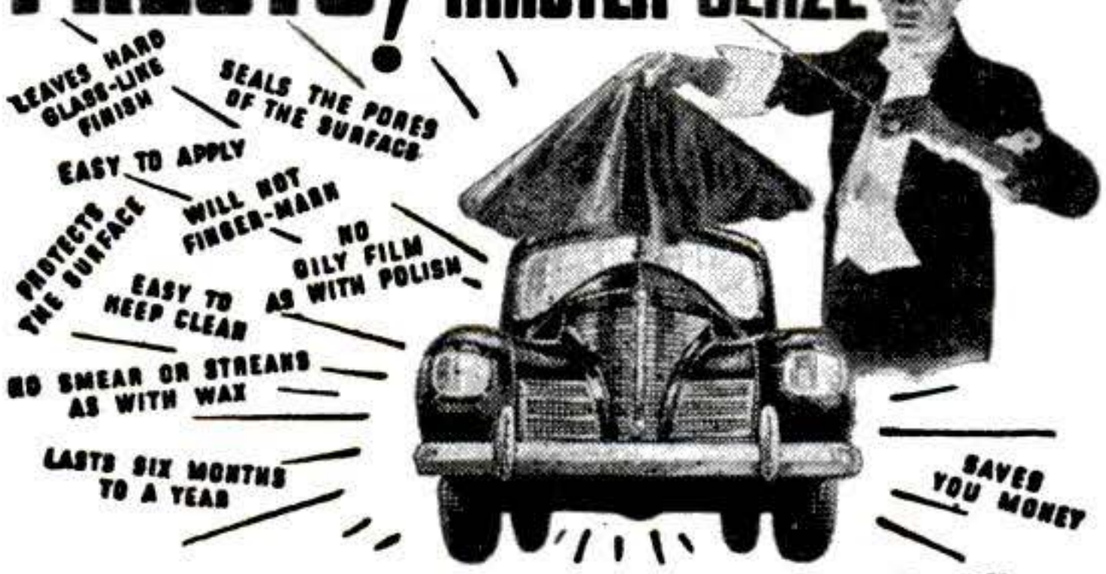

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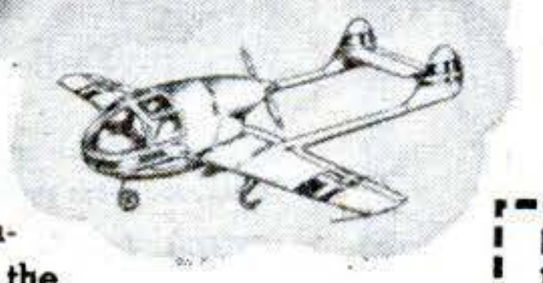

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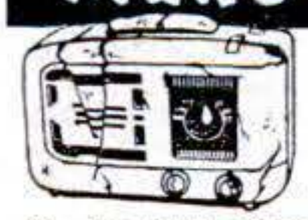

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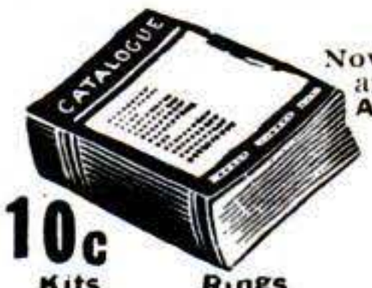

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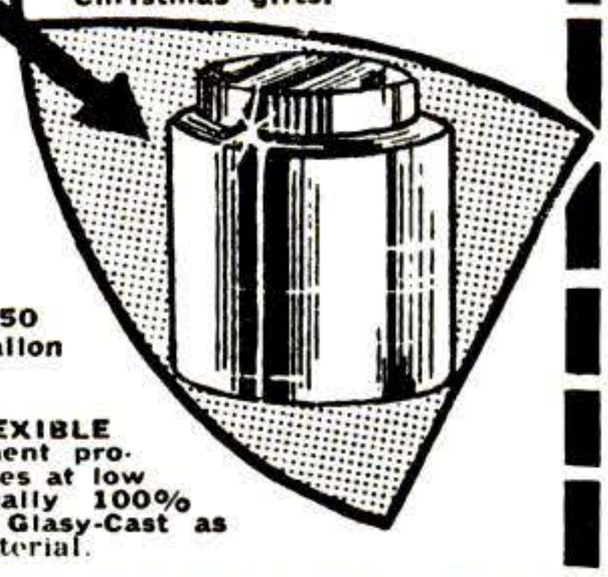

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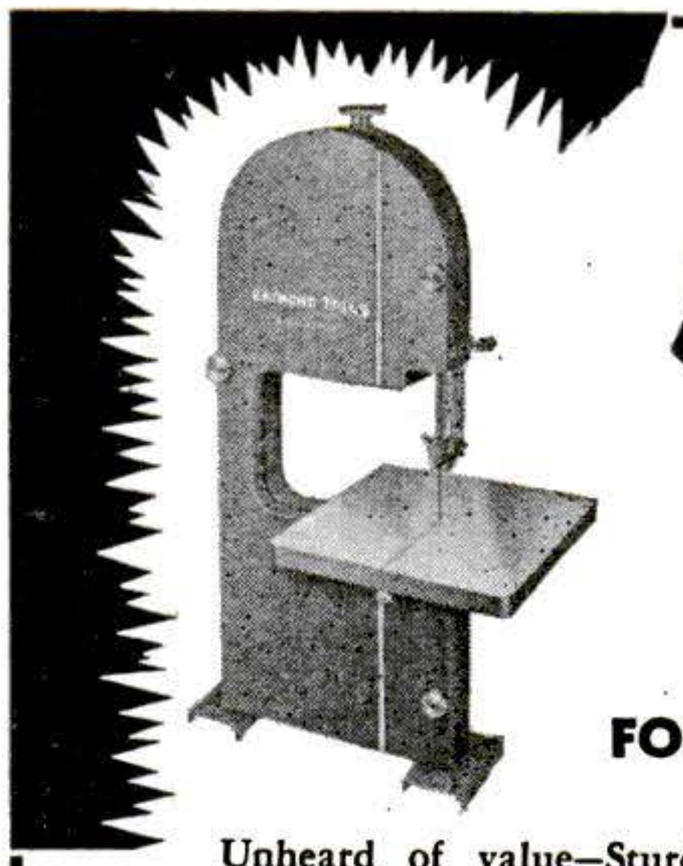

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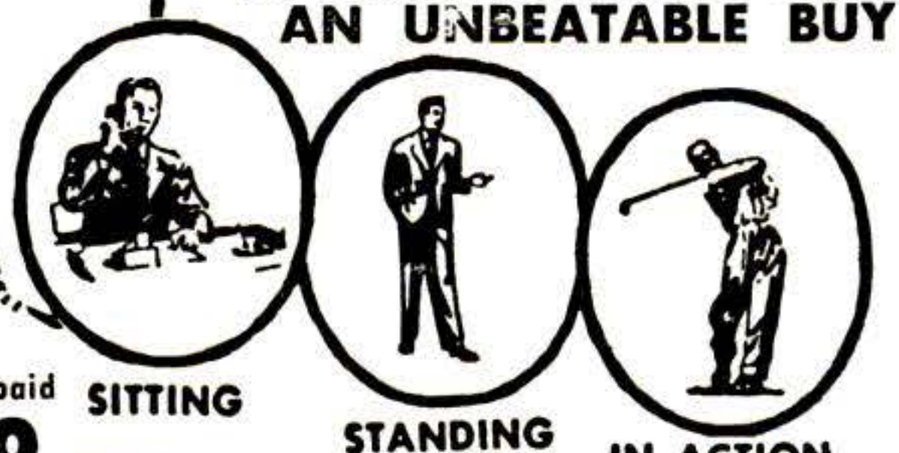

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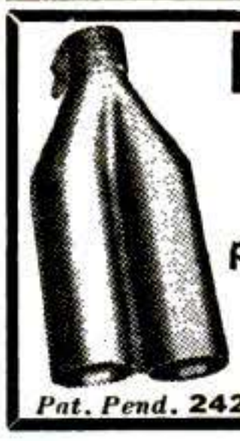

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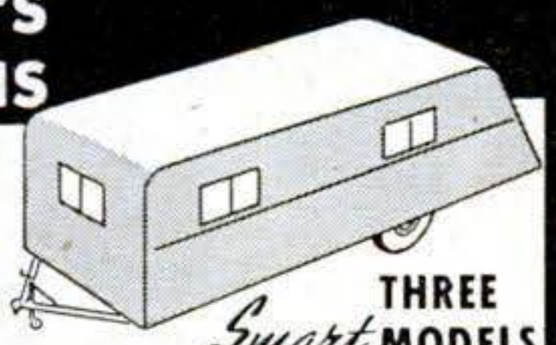

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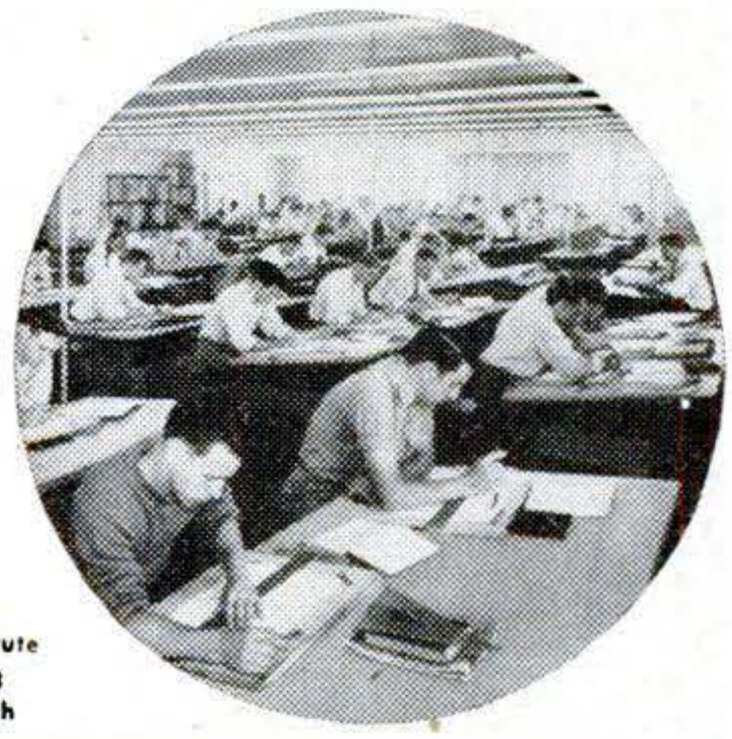

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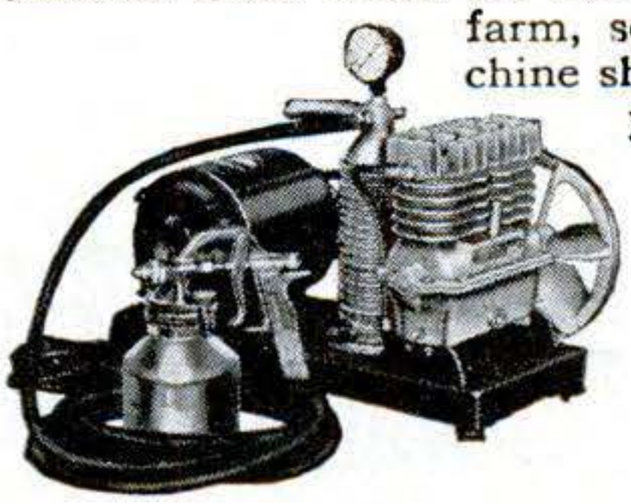

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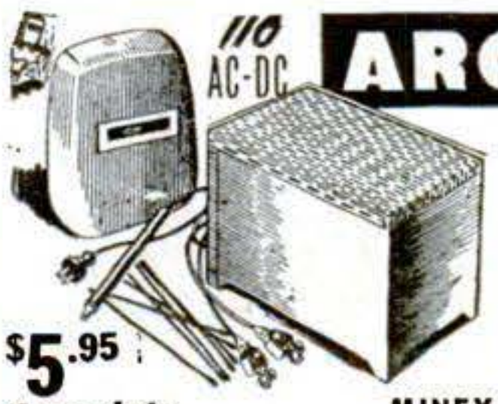

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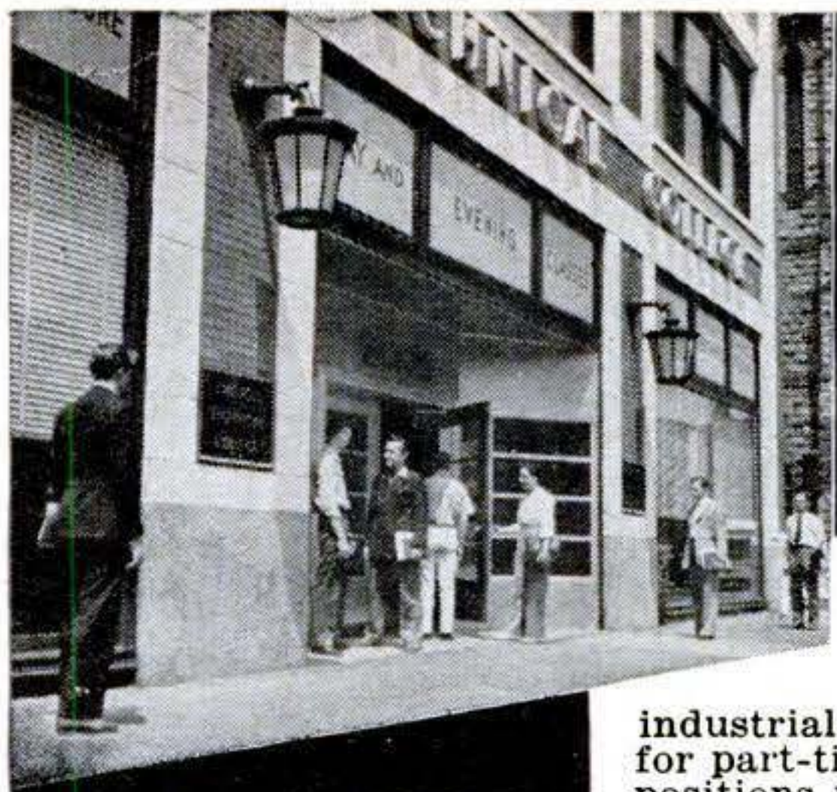

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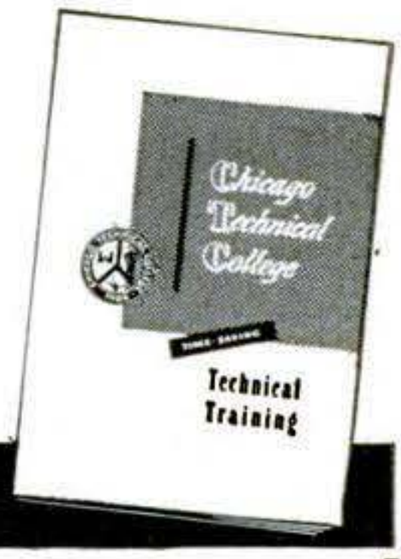

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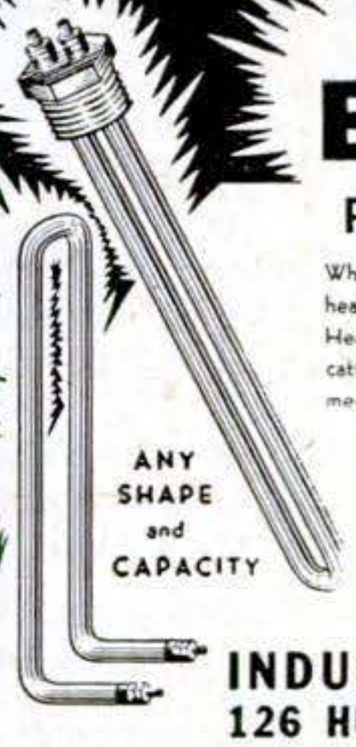

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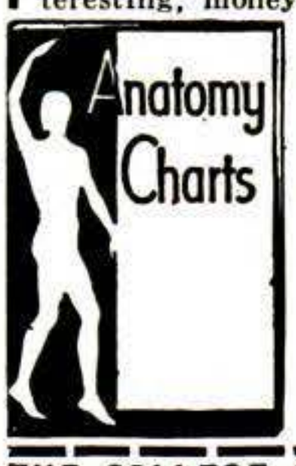

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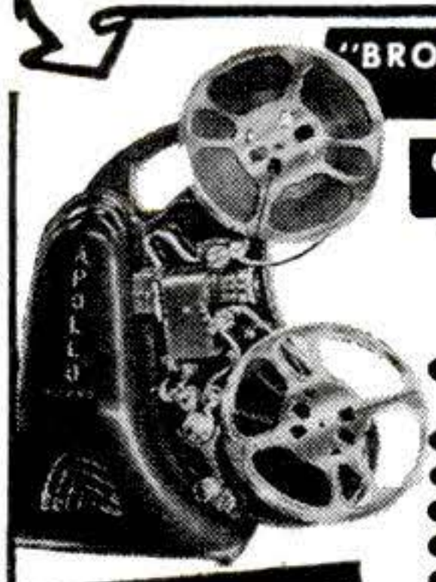

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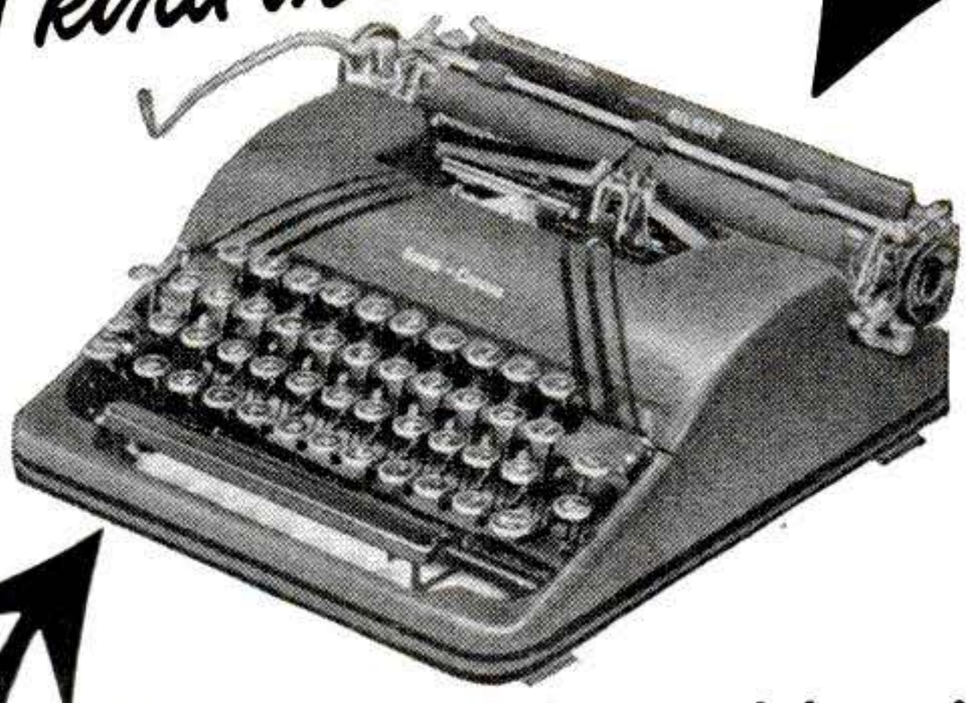

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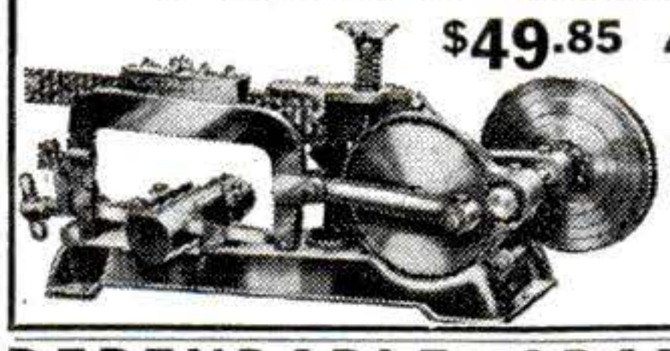

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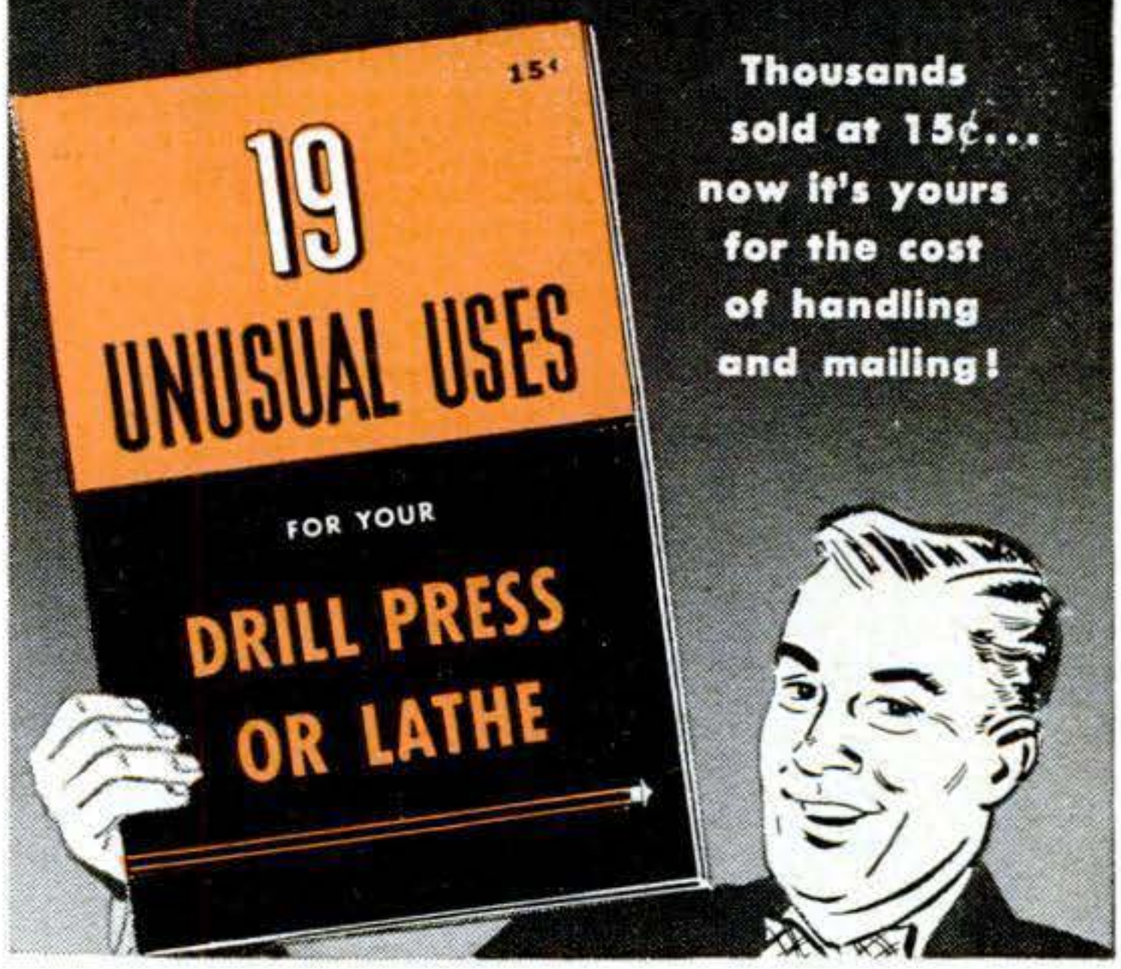

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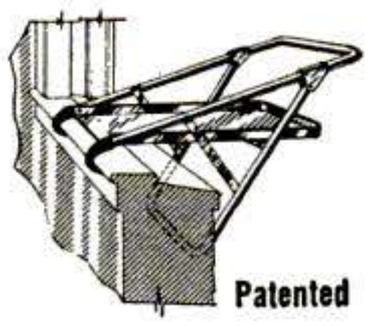

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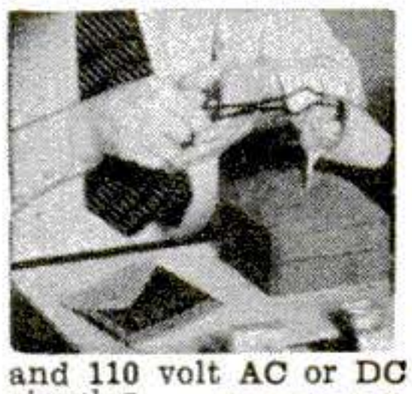

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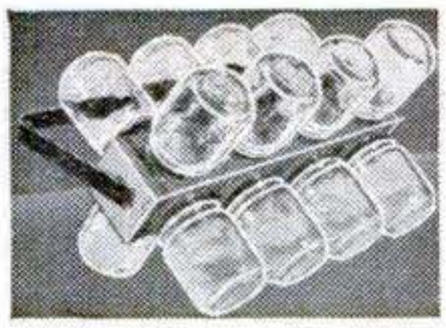

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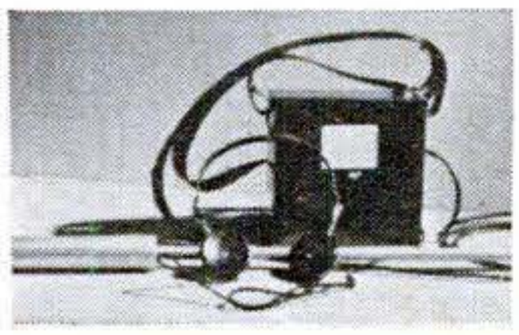

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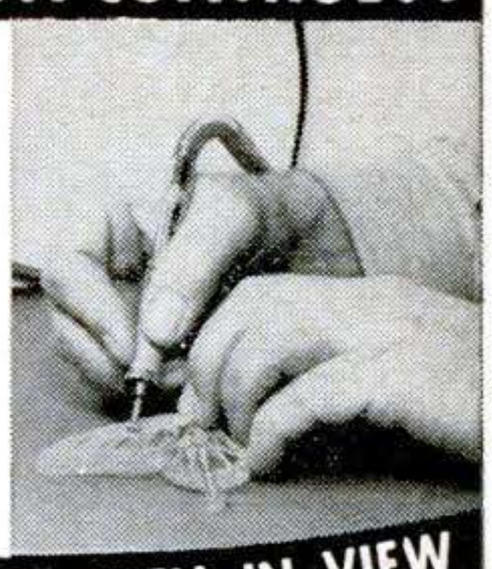

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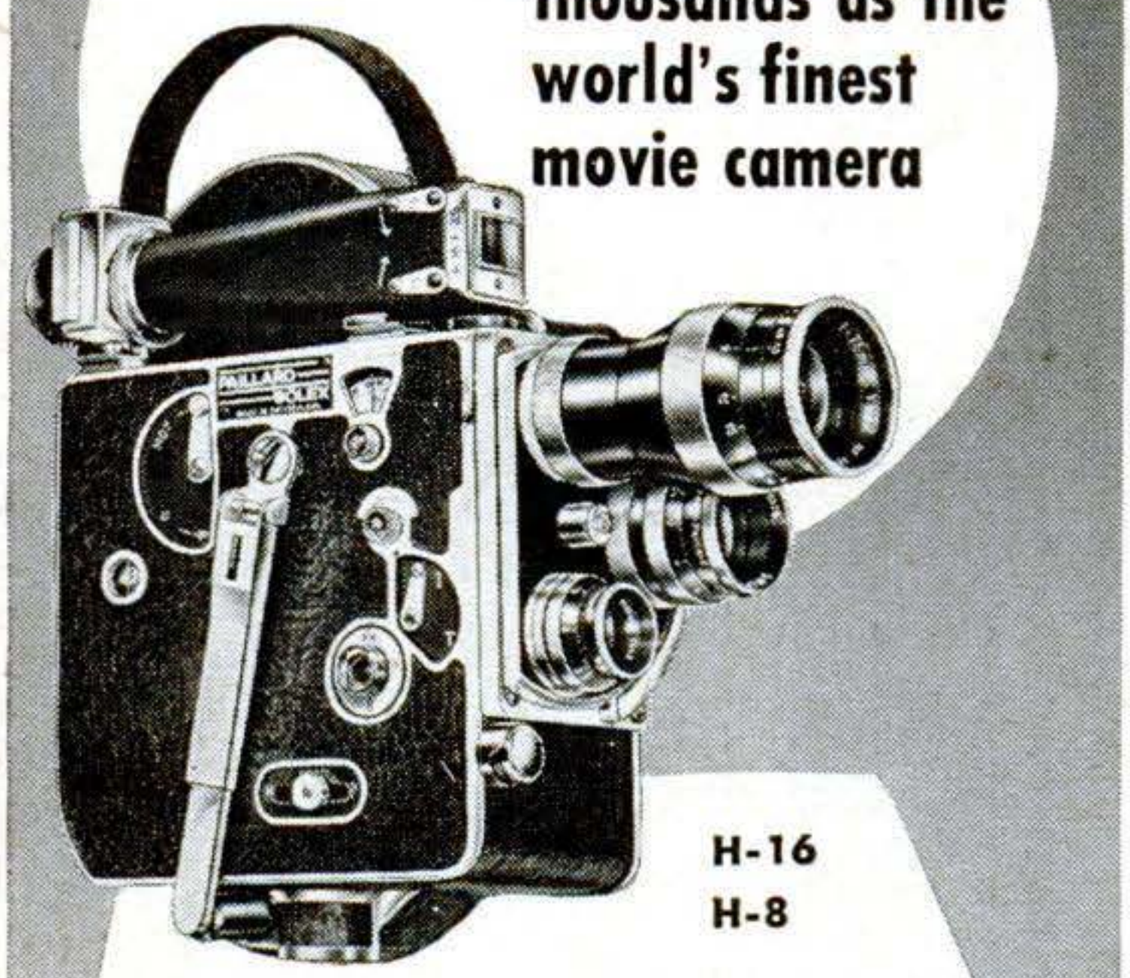

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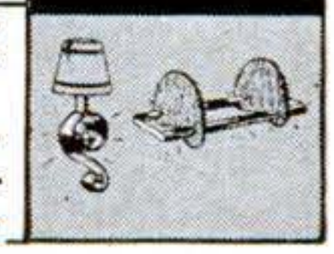

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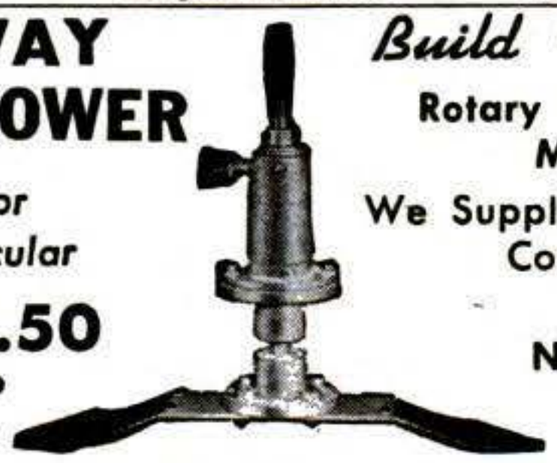

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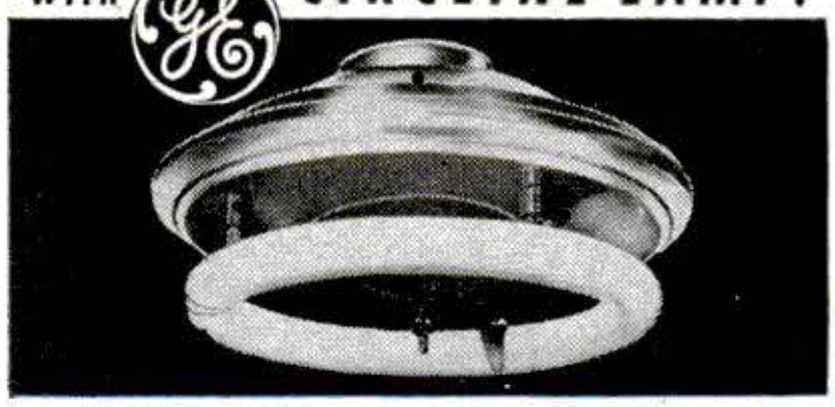

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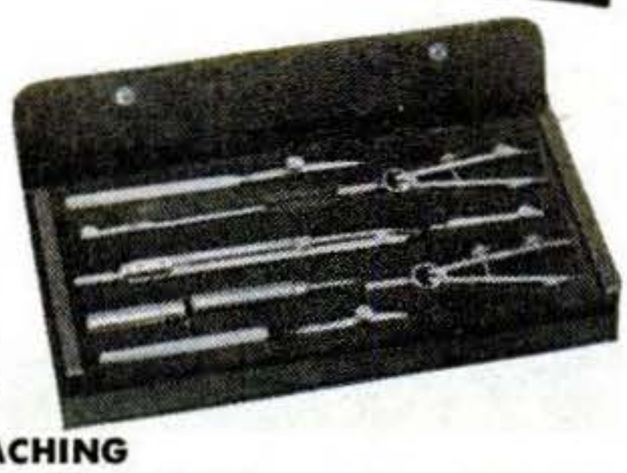

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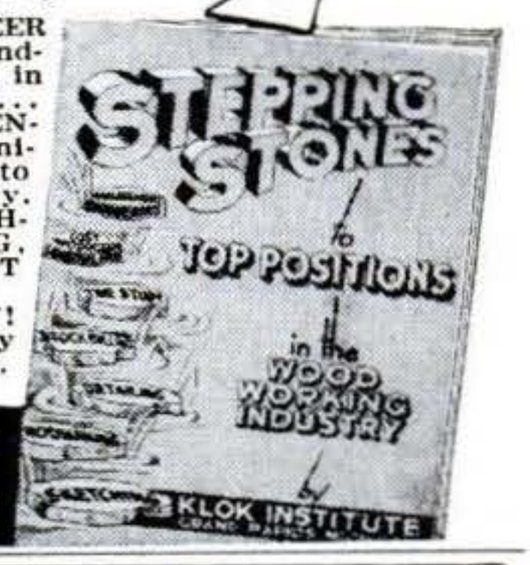

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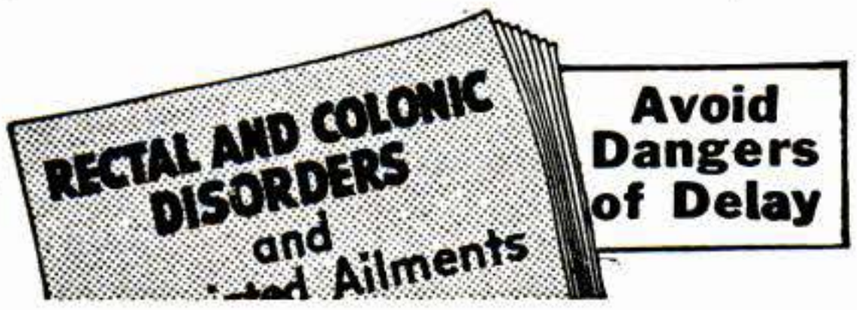

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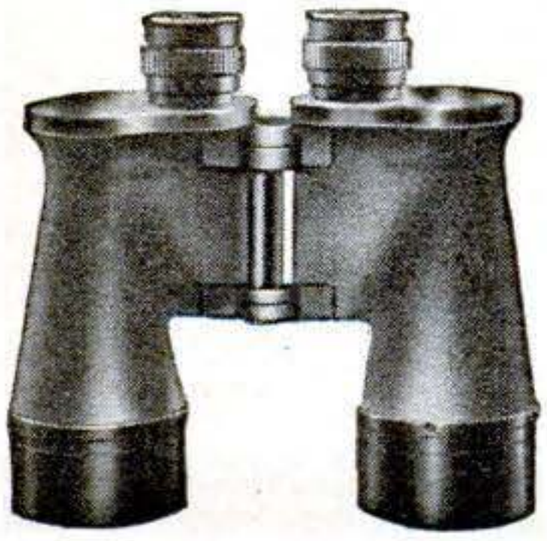

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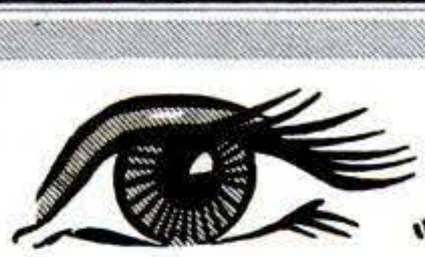

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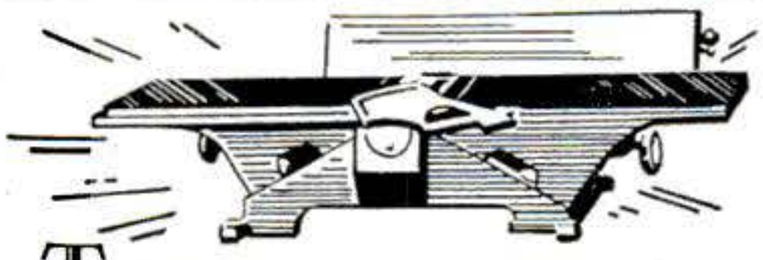

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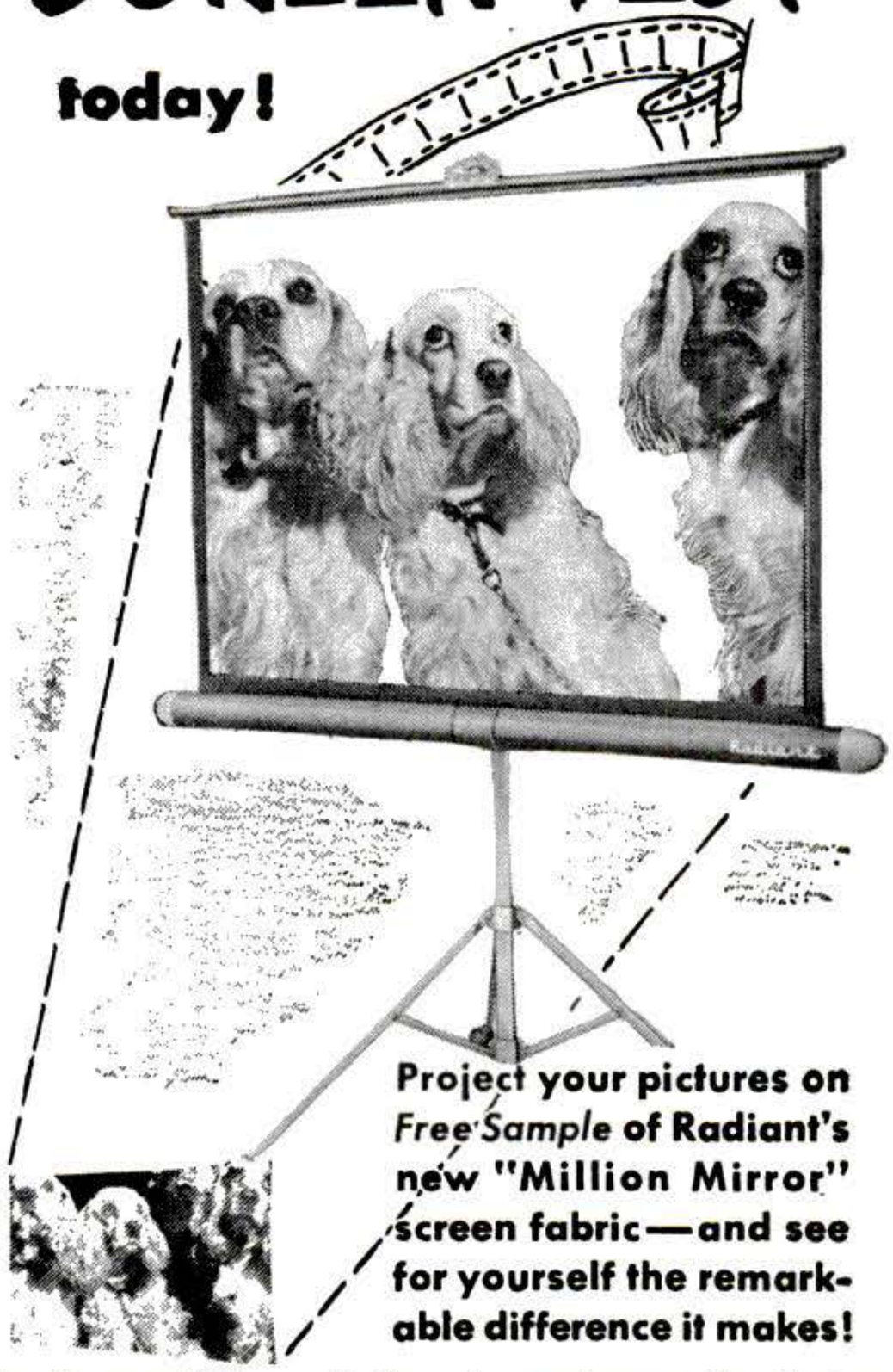

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MAKE Money By Mail. Howard, 1778-B Hamburg St., Schenectady 4, N. Y.

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PROFITS. Big demand and repeat orders selling rubber mats for home or auto. Free sales plan. Mitchell. Dept. PS-3. 2140 San Fernando Road. Los Angeles 41.

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WASHING Machine, Vacuum Cleaner Parts. Andy's, 4325 N. Ottawa, Chicago 34, Ill.

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$10,000 OFFERED by U. S. Government for each usable uranium find. Write for free information on Goldak's new ultra sensitive Geiger counter for prospectors of radioactive ores. The Goldak Company, Dept. S, 1544 W. Glenoaks Blvd., Glendale 1, Calif.

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CASH for Cameras, Microscopes, Binoculars, Tools, Scientific Instruments. Gordon, 187 Madison, Chicago.

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How You can find out! Information discreetly developed. Any matter, person, problem, anywhere. Personal-Business assignments, representations undertaken. Nationwide. Officially licensed, bonded service. Established 1922. Reasonable. Confidential. William Herman, 170 Broadway, New York.

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BORROW by mail. Loans $50.00 to $300.00 to employed men and women. Easy, quick, Completely private, confidential. No endorsers. Repay in convenient monthly payments. Details free in plain envelope. Write State Finance Co., 216 Savings & Loan Bldg., Dept. R-14K, Des Moines 8, Iowa.

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THE PHOTOGRAPHERS FRIEND

10 pieces of precision finished lenses, and first surface mirrors, including the following A 51 mm dia. double lens. A 85 mm dia. lens with speed Fig. a complete set of 3 lenses, one double concave, two objective plano-convex, each having a 12" focal length, one 3⅛" dia. plano-convex lens with a 9" focal length

Also 3 double sided first surface mirrors totaling 37 square inches, worth $10.00.

Make your own projector, portrait and enlarging lens magnifiers, photo spots, etc. You'll brag to your friends about this one for ONLY **$5.49**

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You'll want this one around. 10 micarte and metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made with hundreds of uses.

A WONDERFUL BUY @ **$2.95**

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New 12 assorted types of Aircraft Switches, Including double & single throws, double & single poles & multiples. Voltage ratings from 5 to 20 amps. 125 Volts A. C., 35 amps. 24 Volts D. C.

A 1001 uses in Auto, Truck, Tractor, Jeep, Shop, Radio, etc. **$2.95**

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168—Reamer Assortment: Special Taper line finish Reamers - High Speed Steel. Slightly used but in excellent condition. Ten assorted sizes ranging from .186 x .165 and .244 x .215 to .425 x .385 and .432 x .403. One alone worth our selling price of ten.

For set of ten Reamers **$4.49**

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#168A - Countersink Assortment: Excellent condition - High Speed Steel. Assortment of ten 100° and 110° with pilot sizes ranging from 3/32" to 3/16". For Ten **$2.69**

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SWIVEL

2 Needle bearinged 6" Casters joined as a unit on a 7½" x 8" rubber protected steel face plate. The unit is 9" high and will completely swivel. Ball bearings in swivel entirely enclosed and protected. Bolts Furnished.

If you have to move heavy machinery or jigs these are just the unit. At a Fraction of its cost. Unit **$9.85**

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Fuel/Air Ratio	Right and Left Indicator	Oil Pressure Gauge
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These Instruments contain sensitive meter movements, Miniature gyros, jewels and ball bearings, gears, valves . . . a treasure trove of fine parts.

APPROXIMATELY $2000 GOVERNMENT COST FOR ONLY **$16.95**

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Packed in attractive lucite box, with covers and dividers. 15 Pieces ..... **$1.39** Set

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Counts 0 to 999, each drive advances figures one numeral. Manual single pole, double throw switch has neutral position and serves to reel forward and reverse, with red jewel instrument light to indicate winding operation.

Reset dial to turn counter back to 0.

Assembled in compact 2"x2⅜"x5⅜" box.

$2.69 Each

Loading Switch MC 432

Containing many electronic parts including 5 position multiple switch, 4 micro adjustment rheostats, fixed resistors, etc. A profitable Investment @ **69¢** Old Reliable for the AAF.

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21" long 5" dia. Protection against docks for small boats. $6.50 Value A Steal at **$1.95**

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Exactor Controls. Eliminate complicated rod linkage for throttle control on boats, gasoline engines, etc. These two units connected with ¼" tubing and filled with oil serves as a precision 1 - 1 ratio 90° throw control with a minimum of effort.

Combination Master and Slave **$15.95**

AIE CO OXYGEN REGULATOR

Latest design, sturdy, lightweight - dual gauge regulator unit. Gauge range from 0-220 P. S. I. regulated pressure 0-3000 P. S. I. bottle pressure. Designed for safety factor of 2400 P. S. I. Fits all standard Oxygen high pressure bottles, used in welding, torch cutting, Oxygen breathing.

Compare this value anywhere **$12.50**

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PLOMB SNAP-ON SOCKET SET

6 Sockets, ¼, 5/16, 11/32, 3/8, 7/16, ½.

With Ratchet, Flex Handle, Tee Handle. Chrome, Natural Finish Sockets. Rockwell Hardened. Steel Case **$4.49**

NEW

4 INCH PAINTERS DUSTER BRUSH Only **59c ea.**

PEXTO PLIERS Side cutting beveled head a $3.50 Value Only **$1.79** #121

RAWHIDE MALLET

2½ lb. with metal center, insert type, head, 1¾" x 4⅞". Used for non scaring of metal or plastic surfaces, driving pins, etc. leather replaceable. A $3 VALUE for ONLY **$1.19**

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METAL SNIPS Compound action, Hard steel blades. Expansion spring. Locking device. Right Hand and Left Hand **$2.59**

BC 306-A NEW SIGNAL CORPS TUNING UNIT

In heavy alum. case with black crackle finish-18"x10"x8". Velvet vernier dial knob, calibration 0-100, with locking assembly. Switch - 5 position with knob. 4½" diam. coil with three others inside, and movable induction tuning coil. WORTH MANY TIMES MORE **$1.89 ea.**

Radio ANTENNA Reel

#711

Just the thing for tuning beam antenna.

Powered by ⅛ h. p. 24v G. E. Motor. Removable 6" Reel-limit Switch - Cam Worm gears, Bevel gear, Solenoid clutch.

Motor engaged to gear reduction only when electrical contact made. Operates in either direction. Ideal for auxiliary power take-off, opening and closing doors, etc.

A TREMENDOUS VALUE **$4.29**

HS 33 NEW LOW IMPEDENCE RADIO HEADSET

Excell. Condition Low Impedence

The latest and most improved style, currently in use in aircraft. New. Packed in original boxes. Leather head band, sponge rubber ear pads. Includes CORD and JACK **$3.25**

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HEADSET HS-30-U Two Magnetic Type receivers in watertight brass case. Soft rubber inserts in each receiver to fit into wearers' ear. Pliable steel head band. Ideal for communications, divers, workers in noisy compartments, etc. NEW! **$1.59**

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Highly Sensative with thumb control button on handle. Ideal for home recorders, public address systems, etc. Comp. with 2 ft. rub. cd. & telephone plg. Only **$1.19**

Rope

AT REAL VALUES!

3/16 dia., 3 strand, cotton	.01 ft.
¼" dia. Treated Navy laynard, in 300 ft. rolls	$1.95
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¾" dia., 3 strand, sisal	.08 ft.
⅞" dia. 3 strand, sisal	.08 ft.

VINYLITE TUBING

Capable of insulating up to 5000 volts. This Plastic tubing used for protecting wire, decorative purposes, water or other fluid hose.

	Price per ft.
1", Black, Clear, Red	.15
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½", Grey, White	.12
3/16", White	.02
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No Sale Under $1.00

Above sizes are only a sample of the stock we carry, should you desire other sizes or types please send us your inqury.

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Capacity 21.7 gallons. Aluminum 4 threaded ports. Filler Capacity. Size 7" x 28" x 28". Ideal for Water or Gas Tank on Auto, Boat, Truck, Tractor, Etc. New. #126 **$5.29**

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10,000 in various popular makes, sizes, types, Cleco, Aro, Ingersol Rand, Chicago, Pneumatic, Buckeye, etc.

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GUNS Pistol & Gooseneck Type

101 Uses. Chipping, Riveting, Hammering, Breaking cement and auto body work.

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with ¼" JCB Chuck

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3 Extra filters - Red, Green & Amber 93c Set

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110 V. A. C. 13 ft. wire with socket, switch and plug. In mounting bracket suitable for home or workshop. Wire alone worth our price of **99c** each.

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ATTN. SPORTSMEN, OUTDOOR WORKERS! THIS IS A MUST FOR YOU!

This powerful battle tested lantern complete with 2 standard 1½ volt dry cell batteries. One of the finest hand portable signaling and lighting units throws a terrific beam. Size 6" x 7" x 4" with a 4" dia. reflector. Comp. Only **$3.29**

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Overall Width	Length	Price
1¼" (⅝ side)	72" alum.	$1.00 ea.
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1½" (¾" side)	53" cad. steel	.75 ea.
3½" (1¼" side)	33" steel	$1.00 ea.

AIRCRAFT CABLE

Alloyed steel, rust resistant, 3/16" dia. 18 ft. long, with turnbuckle ends. On reels in any length **99c** ea.

1/16"	3c ft.	3/16	6c ft.
3/32	4c ft.	¼"	8c ft.
1/8	4½c ft.	9/32	9c ft.
5/32	5c ft.	½"	12c ft.

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NEOPRENE SHEET RUBBER

	Thickness	approx. Width		Price per rang. yd.
#325	.020"	1/64	36"	.75
#328	.032	1/32	22"	$1.39
#329	.125"	1/8"	46"	$4.75

Item #329 is laminated rubber sheet with cloth center. Flexible but very fine for heavy wear.

Rubberized Hosp. or Bed Shts. 54"x72". $10.00 Value Only **$2.29**

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#198

110 Volt A. C. Vulcan $8.50 Value

#198	200 Watt	$3.95
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WORLD'S LARGEST SUPPLY
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Priced to sell at 15% Gvt. Cost

PUMPS, New Hydraulic, Vacuum, Air

P-1 HYDRAULIC PESCO TYPE
Positive displacement gear type. Capacity: 1 gal. per minute, at 1500 R. P. M. at 1500 P. S. I. Operating speed: 3700 R. P. M. intermittent maximum 4500 R. P. M. Rotation: either direction with slight adjustments. **$9.49**

800 GPH at 30 PSI. can also be used as hydraulic for 4 GPM at 400 PSI. or for Vacuum drawing 15 in mer. at 1500 R. P. M. **$6.29** ea.

GAS ENGINES HERE'S A TERRIFIC VALUE PARADE IN CHEAP POWER.

10 H. P. CONTINENTAL GAS ENGINE
4 cylinder. Magneto Spark. built in Gas Tank. Water Cooled with Radiator. Complete with Tachometer and mounted on heavy steel frame for portability. A very smooth running job. Used but in guaranteed condition. Above engine used to drive pump described and priced below **$175.00**

WATER PUMP WIP-1 100 Gallons per Minute.
75 ft. head pressure, with 2" standard pipe ports. **$159.00**
PUMP SOLD SEPARATELY OR
PUMP AND GAS ENGINE SOLD TOGETHER AS ONE UNIT ... **$325.00**

Genuine Red Seal 4 Cycle Air Cooled L head
CONTINENTAL GAS ENGINE
1½ to 2 H.P.
standard equipment inc. Mesh type air cleaner. flywheel. magneto. float type carburetor. blower housing. muffler. fuel tank. fuel filter with shut off valve. starter pulley. etc. The ideal power package for light tractors. lighting plants. compressors. boats. lawn mowers. etc. And cast your eyes at this price
Used but Guaranteed Condition..... **$32.75**
Net weight 43 lbs.
A $75.00 VALUE NEW For ONLY **$47.95**

New BRIGGS & STRATTON MODEL "A" GAS ENGINE

Rating 2.10 H. P. 4 cycle. single cylinder. Complete in original Factory Crates. A $102 Value for Only **$64.95**

AIR COMPRESSOR

New Westinghouse
Thousands now in use for spraying. inflating. tractors. trucks. garage. laboratory. air tools. industrial use. etc. Lightweight but powerful. can be run by ½ H. P. Motor or Gas Enging. Operates efficiently in either or rotation. Gives approximately 3.27 CFM at 600 RPM. 6.54 CFM displacement at 1200 RPM. Has 2 inch bore. 1½ inch stroke. Suggested pressure 75 P.S.I. Size 9" x 12" x 16½" Weight approximately 23 pounds.
AT THIS NEW LOW PRICE **$21.95**
Motors. Tanks. Fittings to Adapt this Unit also Avble.

POWER UNIT

The Complete Model GKB 12-24-100 Consists of a Single Cylinder. Air-Cooled. Four-Cycle Brigg-Stratton Gasoline Engine. Type-Single Cylinder. Air Cooled. L-Head. Four-Cycle. 6 H. P. Bore 3". Stroke. 3¼". Governed for Sped Between 2500 - 3200 R. P. M.
Directly Connected to a Direct Current Generator of 2800 Watts. Rating 28.5 Volts. 100 Amps. to form an Integral Unit. Fuel Container 1¼ Gallons.
PU-1
The Engine and Generator are Mounted on Four Shock Absorbing Rubber Motor Mounts Attached to a Channel Iron Base. 4 Wheeled for Mobility can be used as Lighting Plant or Power Supply. A TERRIFIC VALUE!
THE BUY OF THE CENTURY . . ONLY..... **$79.89**

VALUABLE GEARS BARGAINS!
#112
8 to 1 ratio. spindle drive .....#110 $2.98
6 to 1 with screw shaft .....#111 $4.98
85 to 1 (can be used for radio. antennae. etc.) #112 **$3.95**
#G-11 10-1 gear ratio **$3.95**

DC GENERATOR 140 AMP

NEW
Direct Current Generator. especially suited for adaptation to homemade welding unit.
A fast moving item at **$17.95**

P-1 GENERATOR 200 AMP **$22.50** ea.

T-1 GENERATOR 12 V., 25 Amps at 1800 to 4200 R.P.M. Trucks Aircraft. Radio. A Real Value **$13.95**

W-1B LARGE HEAVY STEEL
FILTERING TANK

30" dia. x 4' high. Complete with 2 large line filters. line pressure. Gauges. 5-way diverter valve (washing. filtering. filtering to waste. shut. by pass). Chlorination control panel with gauges. pressure regulating valve and tanks. 2" standard pipe plumbing throughout. **$229.00**

Electronic Trnsmissn. Gear Train

GT-1 Containing approx. 50 Bronze Spur & Pinion Gears ranging from ⅜" to 4" dia.. 5 sets of 7 cluster gears. 2 complete worm & worm gear drive sets. 40 N. D. ball bearings from ½" to 1½" dia. watch springs. bushings. posts. face plates. housings. Micro Switches. 2 minature. controlled clutches. etc. 19 lbs. of Pleasure and profit. A Tremendous Gadget Mine. Only **$8.49**
Gears in above train are all in multiple size and sequence with identical teeth ratio giving hundreds of ideal gear reduction combinations.

Vickers Hydrlic Transmission

VT-1
Self contained. 2 H. P. constant torque at all speeds with variable volume reversible. piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure. dash pot for smooth control. Power output R. P M. -0 to ⅓ input R. P. M. in both directions. Input R. P. M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R. P. M. Ideal for Lathes. Duplicator Setup on Mills. Conveyors. Small Cars. Drives. Gearing. Etc.
COST GOVERNMENT APP. $400.00
You'll Chortle when you get it for ONLY **$19.50**
Universal Joints. Gear Trains. Power Take-Offs. Drives Applicable to a multitude of adaptatons. also Available.

Sperry Aircraft Directional
GYRO COMPASS

Precision made for sensative direction 360° swing calibrated in 1/10 degree (6 min) Luminous dial. Built in 3 volt instrument light and and bank indicator 4½" cube metal box with 3" dia. face. Operates on Vacuum. ideal for cars. light planes or boats. Can be used in autos and boats by attaching one tube to intake manifold.
Complete with caging and reset knob. Re-issue. Good Condition ONLY **$4.49**

D. C. METERS

AMMETERS
-30 - 0 - 30+
-60 - 0 - 50+
$4.25

0 - 30
0 - 120
0 - 240
0 - 300
$3.95

#611

Comb. Voltmeter-Ammeter
30V - 30 Amp.
30V - 60 Amp.
30V - 120 Amp.
30V - 240 Amp.
$4.95
30. 60. 120. 240 or 300 Amp.
SH-1
SHUNTS required with use of DC Meters **$1.00** ea.

High Pressure Oxygen Bottle

New. Will hold up to 3.000 lbs. PSI. with Co2 used as tire inflator or fire extinguisher. with oxygen for sick room or deep-water diving. etc. Completely equipped with brass valve. 36" hose. Dial gauge. & canvas bag. **$2.29**

NEW PRESSURE TANKS

Stainless Steel - Shatter Proof. Rustless. 10.000 available in 6 different sizes. 1001 uses.
G-1 12½ x 24 inches 2100 Cu. In. capacity 29 cu. ft. **$4.75**
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F-1 —10" x 18" 1000 Cu. In. capacity... **$3.95**
F-2 6 x 45 in. - 1000 Cu. In capacity 14 cu. ft. **$3.95**
A-4 5" x 8" 104 cu. Capacity **$1.35**
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Excellent portable tanks for carrying air in car or trailer ideal for painting. cooking. spraying. ocean buoys. underwater fishing or diving.
#OR-1 Oxygen Regulator with 500 lb. guage will fit all tanks **$1.39**

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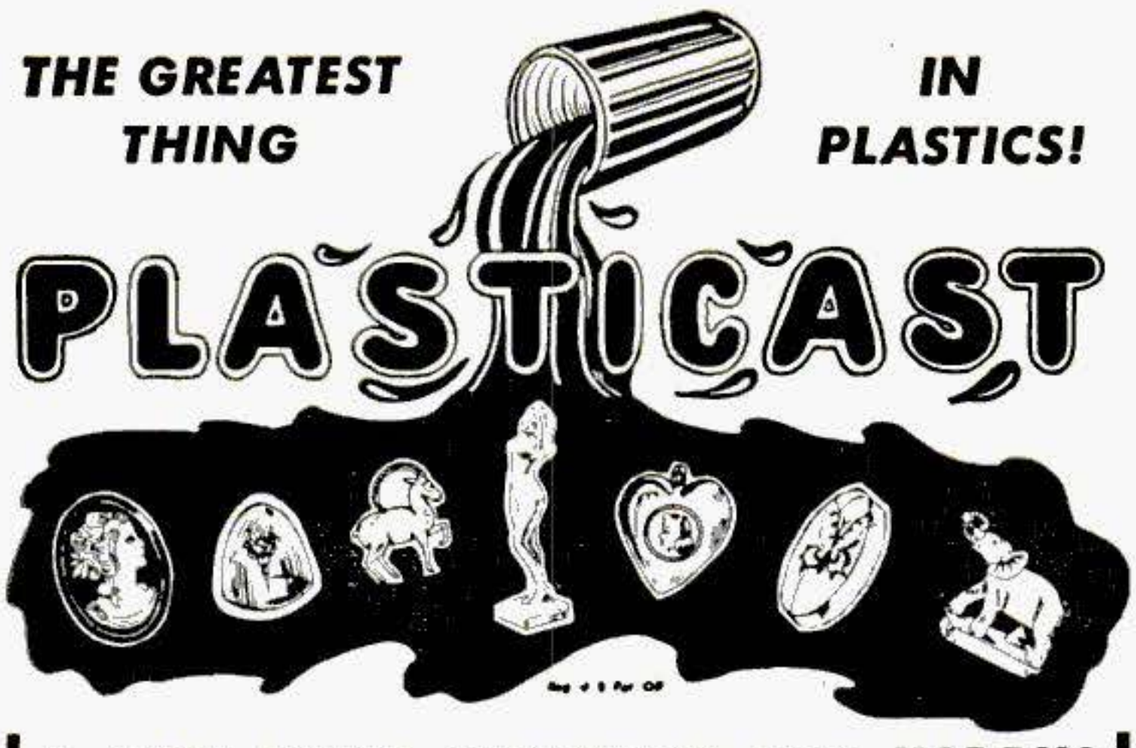

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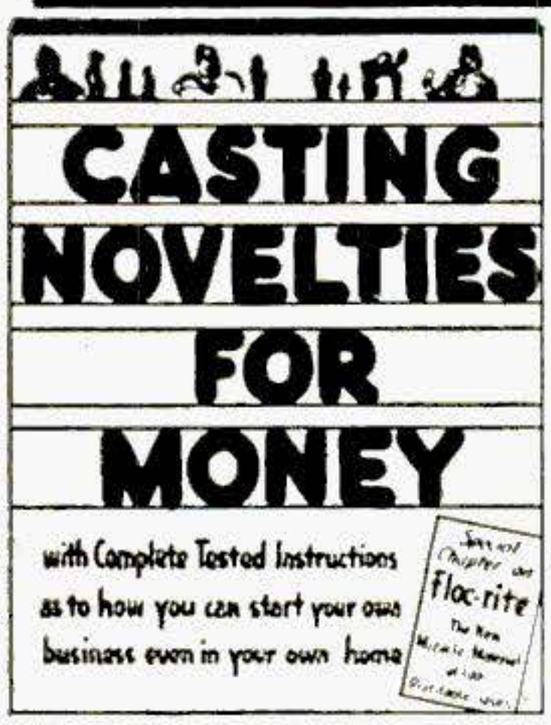

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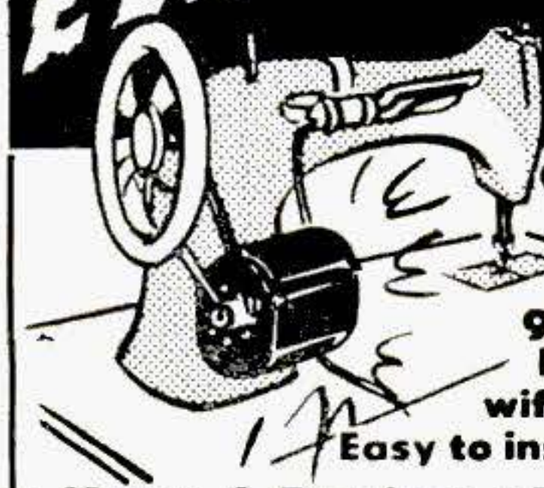

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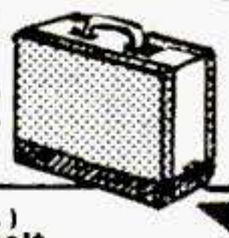

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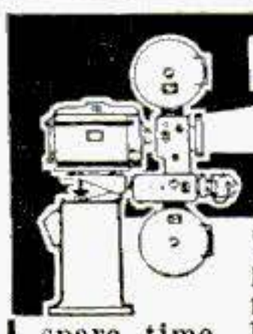

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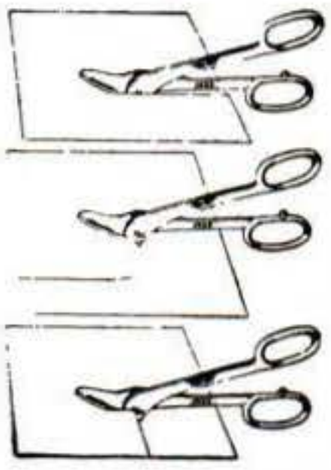

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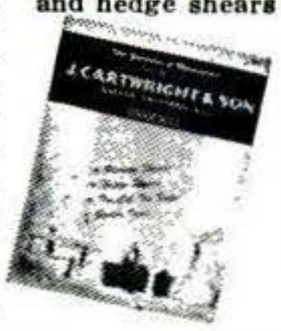

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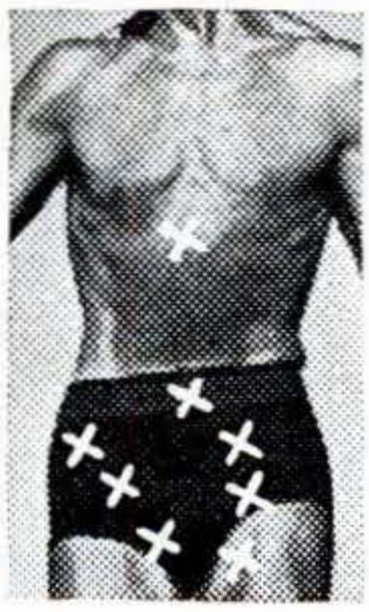

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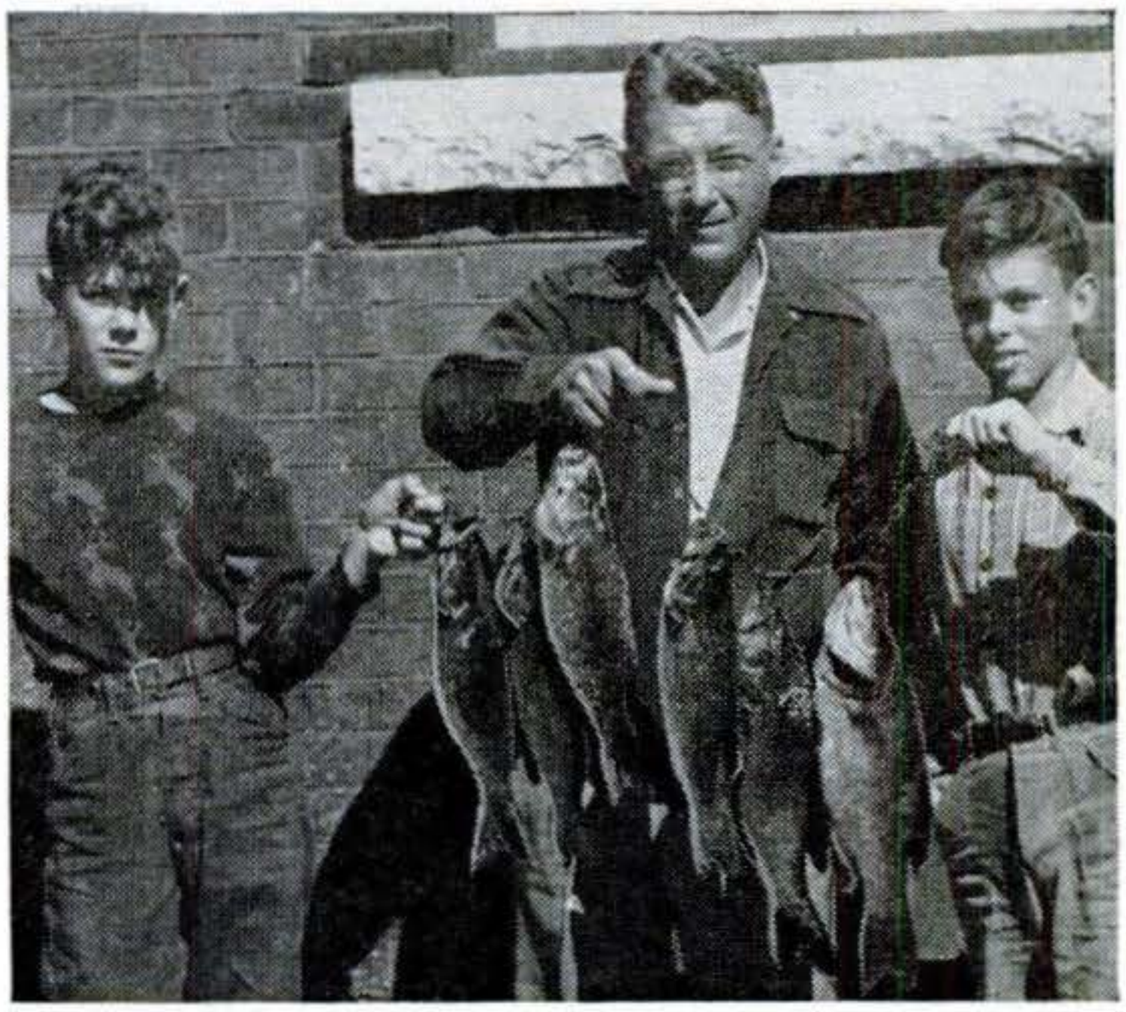

"Our Jitterbug took the limit, each day, at St. Potier Lake, near Whitefish," is the way T. B. Stonerock of Dayton, Ohio, describes this photograph showing his son, Tommy (right), and friend, Peter Farrell (left), with their catch of Smallmouth Bass . . . all weighing over 2 pounds. Mr. Stonerock, the boys and a Jitterbug have a date to fish St. Potier Lake again, next year.

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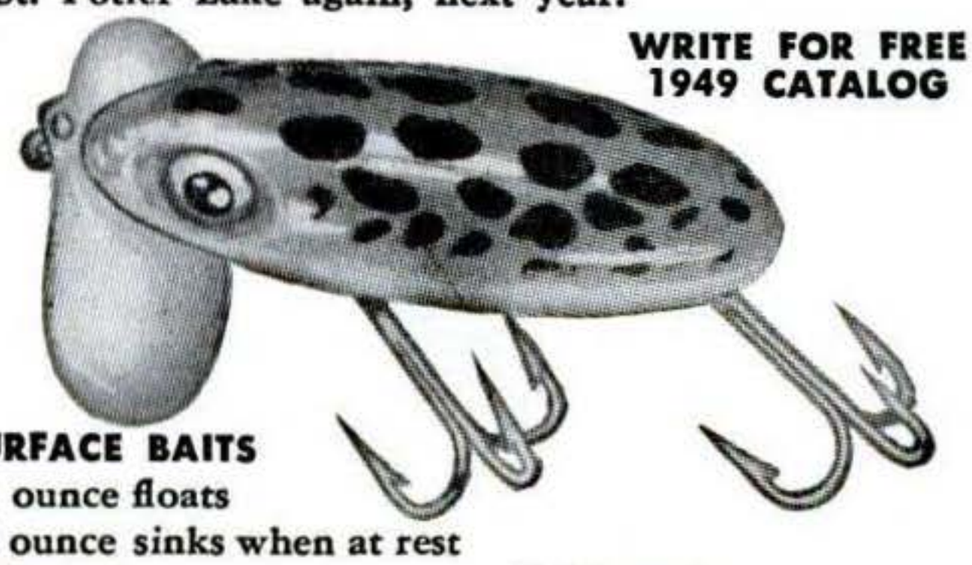

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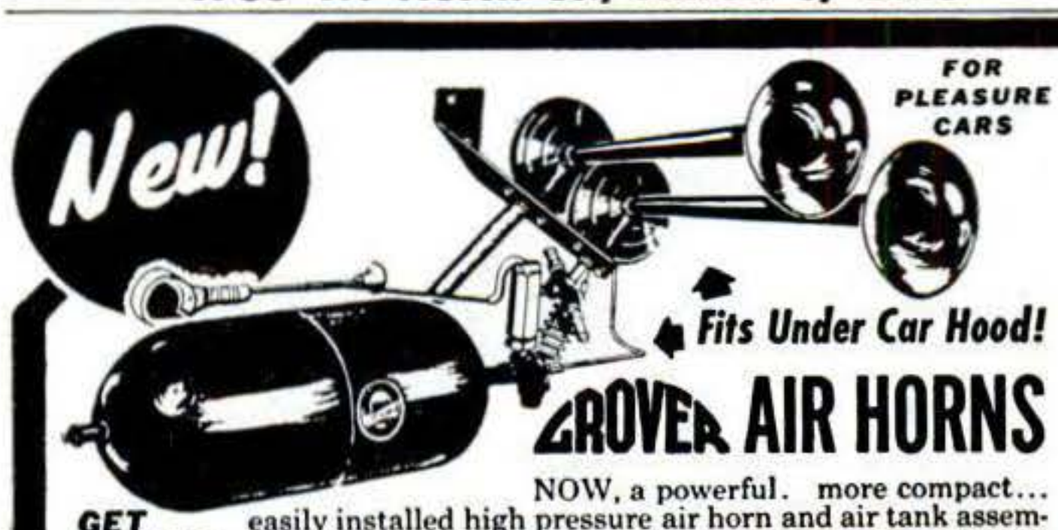

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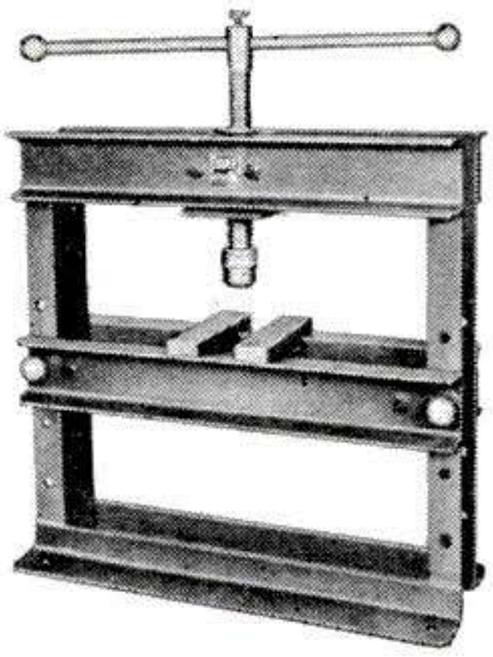

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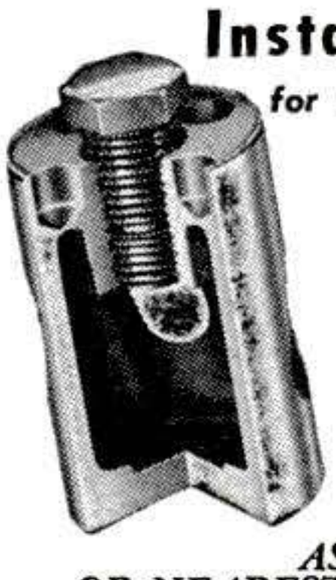

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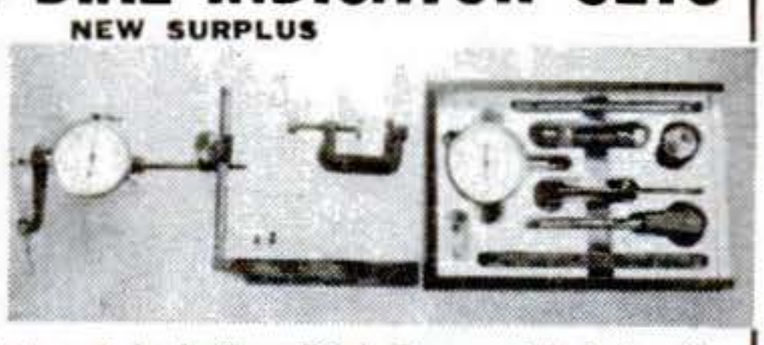

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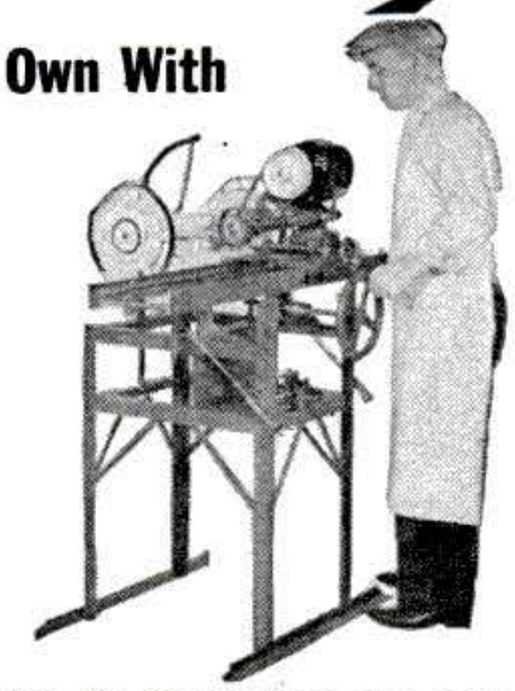

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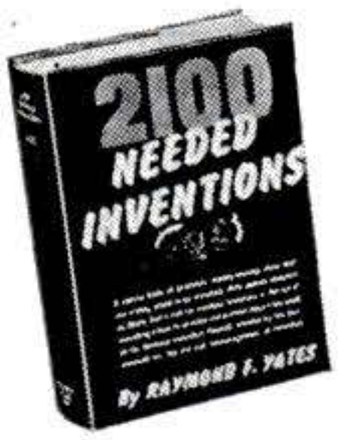

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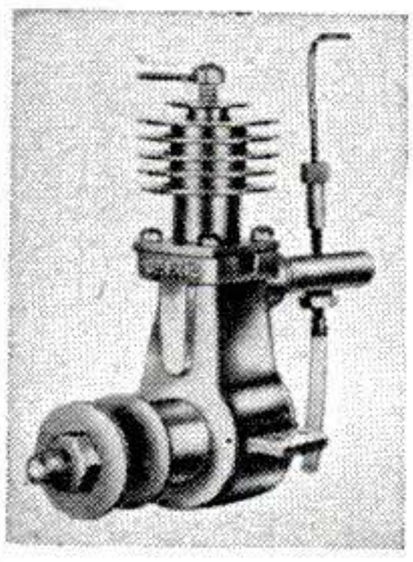

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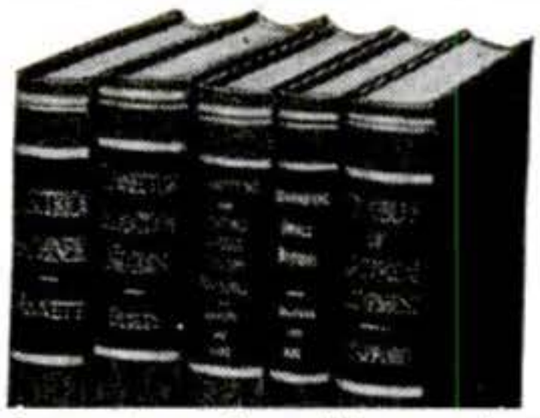

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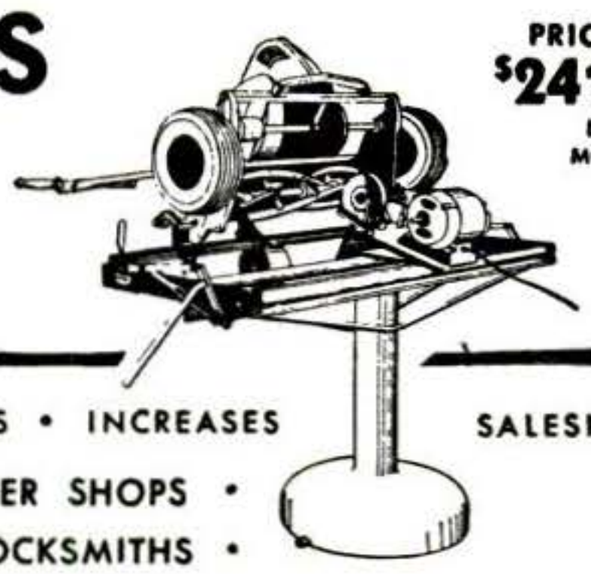

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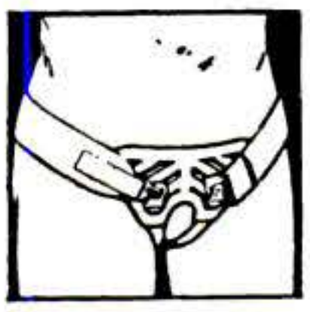

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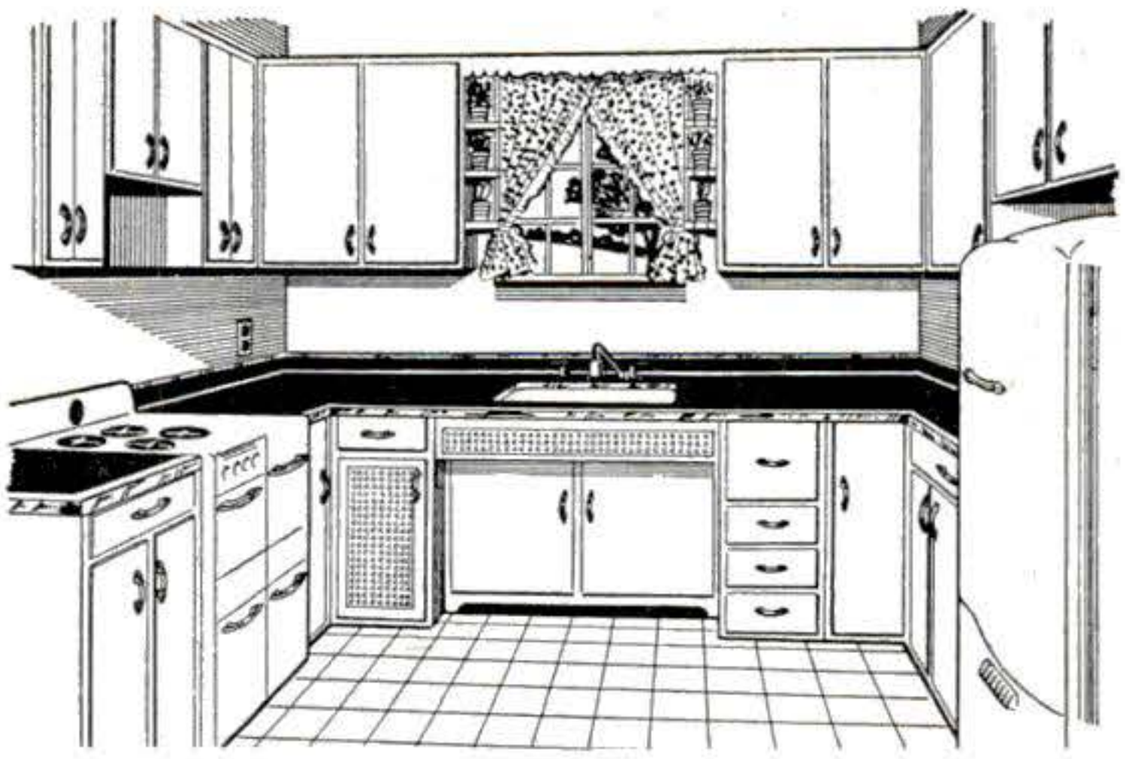

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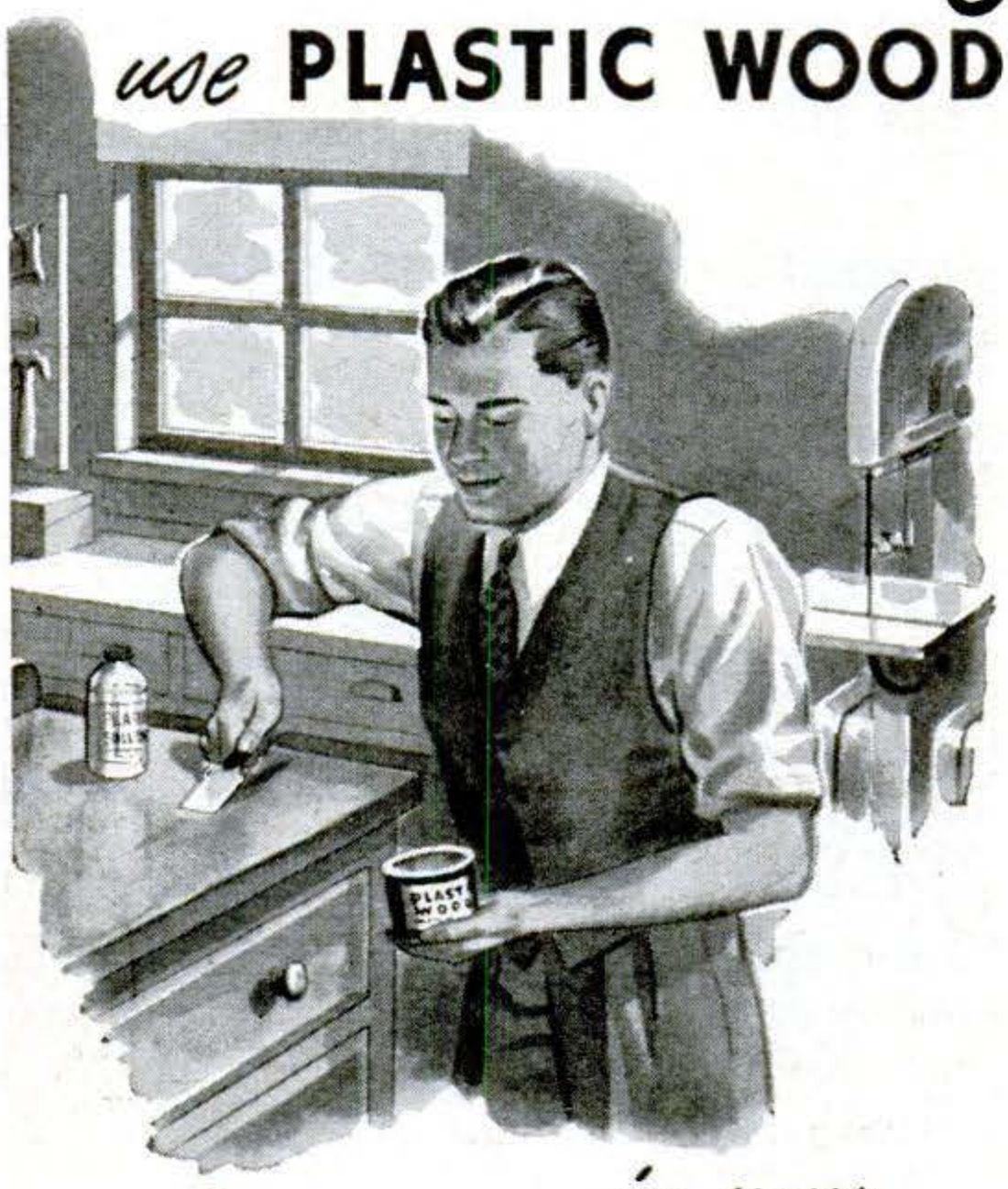

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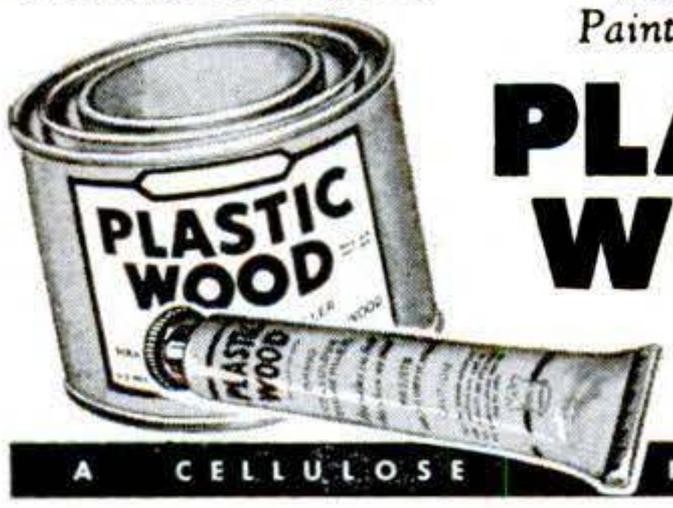

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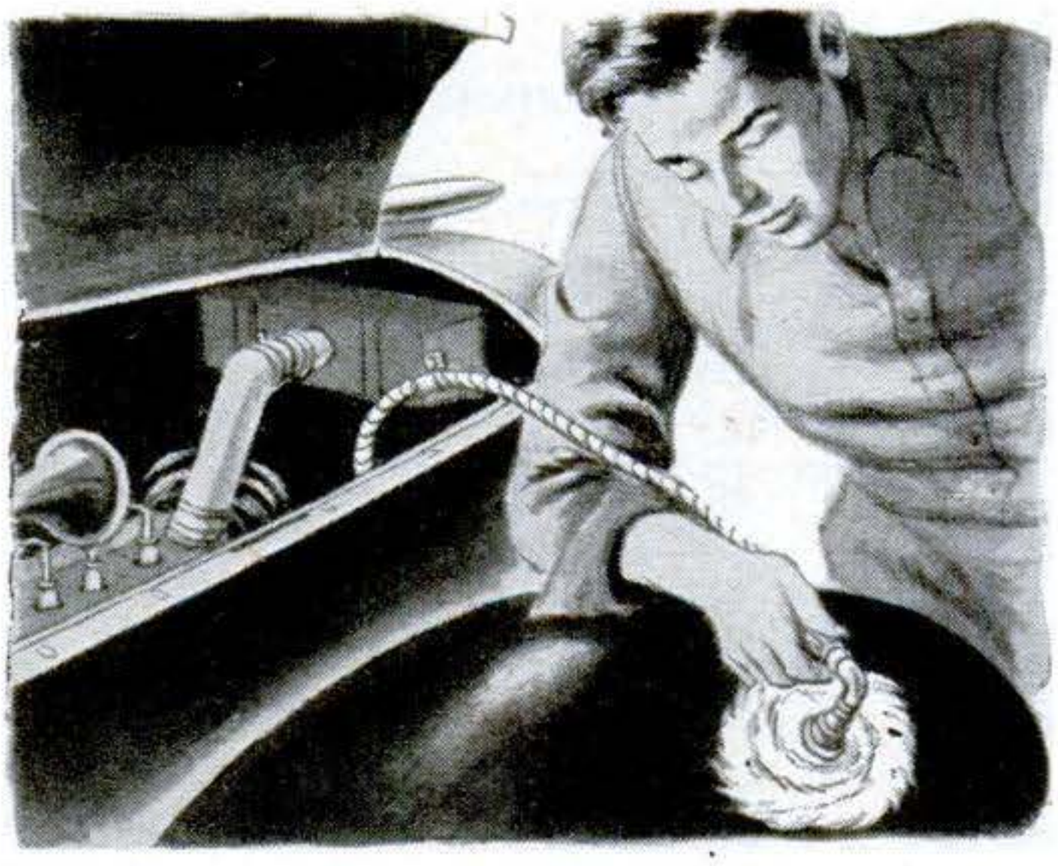
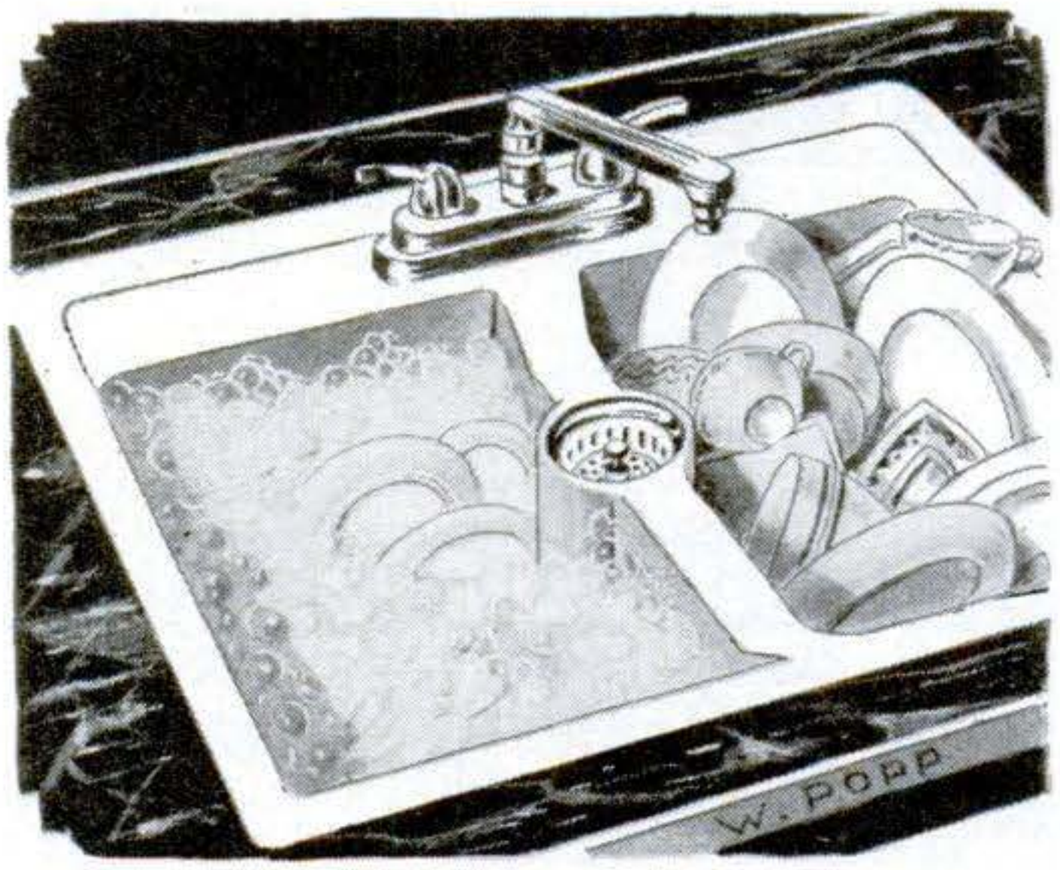
I'd like to see them make . . .

Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



A buffer run by a flexible shaft attached to a car's engine. It could be driven off the fan belt. Then you could park your car anywhere to polish it by power.—*N. R. Rollo, Kansas City, Missouri.*



Auxiliary drains on double sinks. When both sinks were full of soaking and draining dishes, you could pour leftover coffee or other waste liquids in the extra drain.—*Mrs. Jerry V. De Camp, Palo Alto, Calif.*

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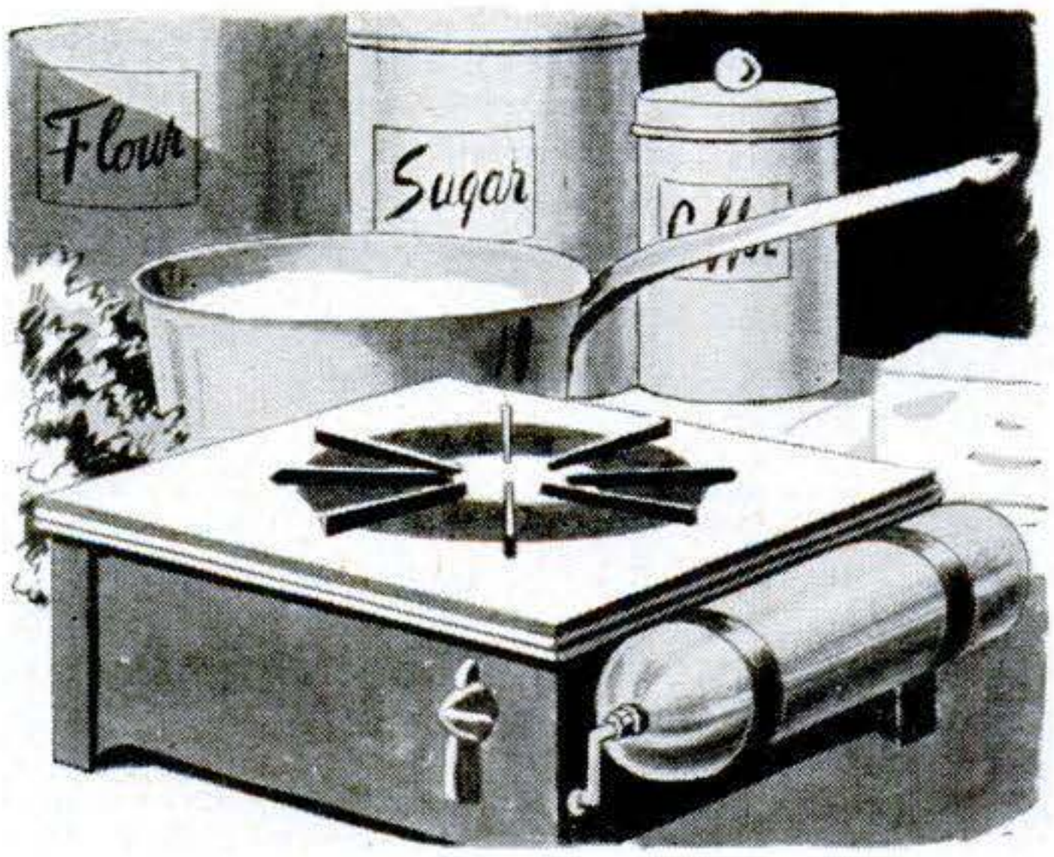
I'd like to see them make . . .

Electrically heated coffee cups. Contacts in cup and saucer would operate it only when the cup was on the saucer. They'd have to be designed so that saucer slops wouldn't short them. —*Leonti Thompson, Manhattan, N. Y.*



A self-contained, bottle-gas burner. It would be a stand-by unit and even if it had only one burner, you still could have hot food when a power or gas failure knocked out the regular stove.—*John Wilson, Chicago.*

A sifter that would measure the amount of flour that passed through it. You could just fill it with flour and a gauge on one side would register the amount of flour that had been sifted. —*Gene Zevely, Moro, Ore.*

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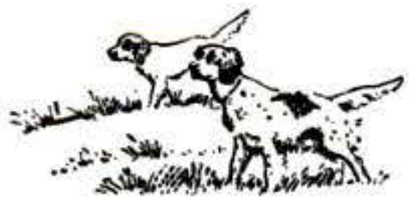

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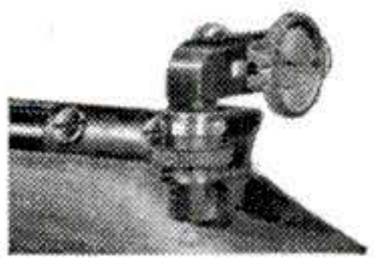
MAN-SIZED STOCKS
Stocks and forestocks of Savage and Stevens "22" rifles are full size, attractively finished, and properly proportioned for steady holding.



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HOODED FRONT SIGHT
Micrometer elevation and windage adjustment. Precision built. Helps build top marksmanship.

TENITE
The beautiful, durable, service-proven gunstock material—permits custom stock features and appearance on guns priced with the lowest. Now available on the Stevens model 87 (illus. at left) as well as other Stevens rifles and shotguns.

Lightning fast, lightweight automatics... accurate, well balanced repeaters (*both* clip and tubular magazine models)... sturdy, dependable "single shots". Take your pick and *pick a Savage or Stevens* "22" rifle for highest quality—greatest value. See these models at your dealer's—write for free catalog.

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STEVENS .22 Rifles—First in value

Model 86 — .22 cal. Bolt Action Tubular Magazine Repeating Rifle. Magazine holds fifteen .22 long rifle; seventeen .22 long or twenty-one .22 short cartridges. Military style stock with pistol grip.

Model 84 — .22 cal. Bolt Action, Clip Magazine Repeating Rifle. Detachable clip holds five .22 long rifle; .22 long or .22 short cartridges. Self-cocking, bolt action. Independent safety.

Model 15 — .22 cal. Bolt Action, Single Shot Rifle. Chambered for .22 long rifle; .22 long or .22 short cartridges. The lowest priced lightweight "22" in the field.

Model 87 — Semi-Automatic .22 cal. Rifle. Shoots 15 shots as fast as trigger can be pulled. Also, instantly adjustable as single shot or bolt action repeater, shooting .22 long rifle; .22 long or .22 short cartridges.

Stevens Models 86S - 84S - 87S; same as above with No. 150 Micro Peep Sight with Hooded Front Sight illustrated above.

SAVAGE .22 Rifles—First in quality

Model 6 — .22 cal. Auto-Loading Rifle — shoots fifteen long rifle cartridges as fast as you can pull the trigger. Also, instantly adjustable as bolt action repeater; shooting .22 long rifle; .22 long or .22 short cartridges.

Model 5 — .22 cal. Bolt Action Tubular Magazine Repeating Rifle. Magazine capacity — fifteen .22 long rifle; seventeen .22 long or twenty-one .22 short cartridges.

Model 4 — .22 cal. Bolt Action 5-shot Clip Magazine Rifle. Chambered for .22 long rifle; .22 long or .22 short cartridges. Stock and forestock of walnut.

Model 3 — .22 cal. Single Shot Bolt Action Rifle. Shoots .22 long rifle; .22 long or .22 short cartridges, regular or high speed. Positive safety. Walnut stock and forestock.

Savage Models 6S - 5S - 4S - 3S; same with No. 150 Micro Peep Sight with Hooded Front Sight illustrated and described above.

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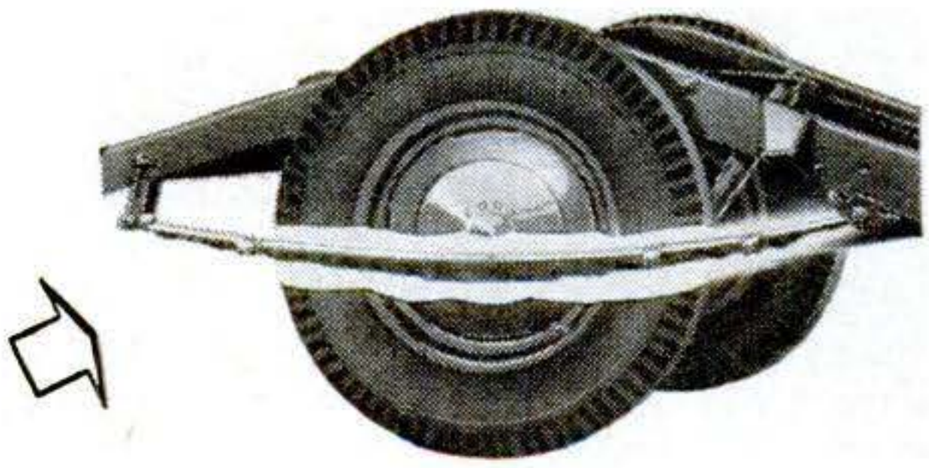
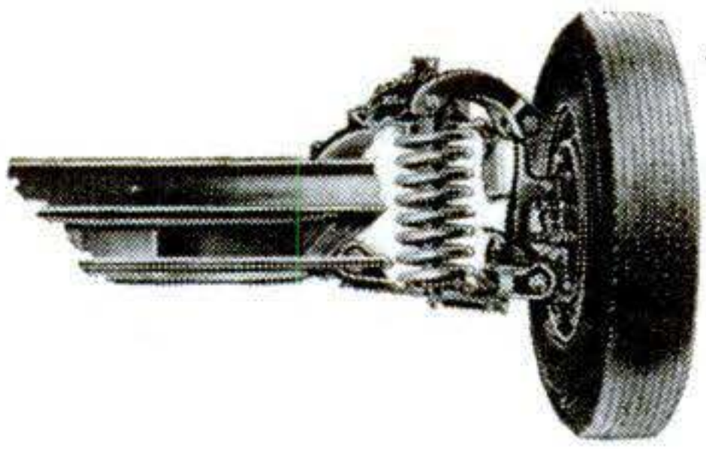
Facts about the NEW FORD "FEEL"

One of the most important things contributing to the New Ford "Feel" is the solid roadability and exceptional comfort of the "Mid Ship" Ride. Seats are scientifically positioned between the wheels to cradle the passengers luxuriously.

In addition, a completely new suspension system is part of the Ford "Feel" of cradled smoothness. The "Para-Flex" Rear Springs are extra-long semi-elliptic type. Impregnated inserts between tips of spring leaves, together with concentrated pressure-type rubber bushings at shackles and brackets, eliminate need for lubrication.





At the front are "Hydra-Coil" Springs in a swinging link independent suspension system. Double-acting hydraulic aircraft-type shock absorbers are mounted inside the coil springs. They can be easily removed and replaced without even jacking up the car. You'll feel the difference in the ride.

Add the new low center of gravity and the 59% more rigid body-chassis combination and you have, as a result, Ford's famed "Mid Ship" Ride . . . an outstanding part of the new Ford "Feel" everyone is talking about.

There's a NEW Ford in your future

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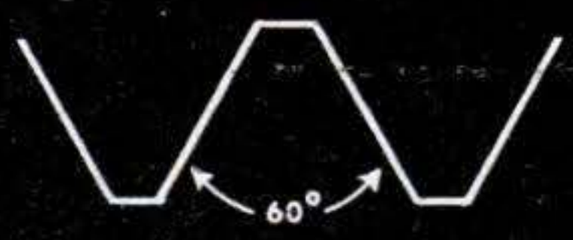
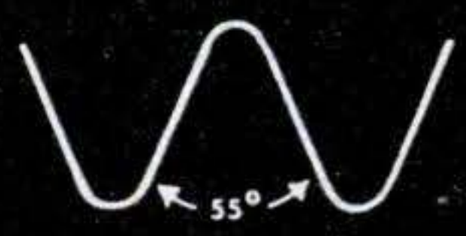
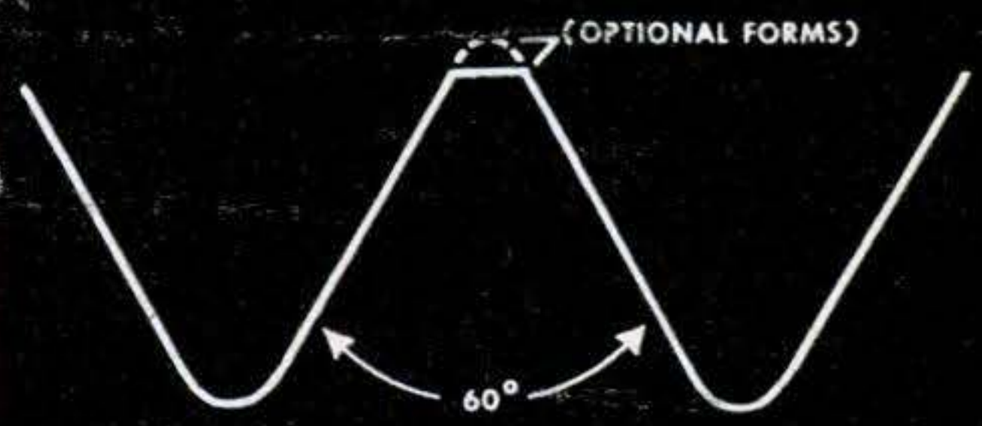


OLD U.S. BOLT THREAD



OLD BRITISH BOLT THREAD



NEW U.S. AND BRITISH BOLT THREADS

Nuts, Bolts & People

NUTS and bolts you know as little things that put big things together. Actually, our whole industrial civilization hangs by a thread—a screw thread.

Ever since the Civil War there has been growing and costly confusion because of the differences in two systems of screw-thread design. The Whitworth thread, Britain's standard since 1845, has a 55-degree angle; the Sellers thread, America's standard since 1864, uses a 60-degree angle.

The differences in shape of thread, pitch (number of threads to inch), and tolerances have, in effect, hung a mechanical curtain between these greatest industrial nations. Two nuts might look alike. But one you could spin on a bolt with your fingers. The other you might strong-arm with a wrench, making a weak joint or ruining the threads. For the nuts, even though the same "size," were as different as Detroit and London—and have skinned knuckles in both places.

The situation became dangerous in World War II. The differences in the two systems forced the manufacture, shipment, stockpiling, and supply to the armed forces of *two* complete sets of much equipment otherwise practically identical. This meant that a British machine gun, made in Connecticut, might be out of action although repair parts, threaded differently, might be available in a nearby American unit.

Now comes news that the long and costly battle of the threads is to end. Beginning, understandably, with military equipment, a new "international" design will match up the nuts and bolts of Britain, Canada, and the United States.

To mechanics and engineers, the "Unified Screw Thread Standard" means that threaded machine parts of these nations will be interchangeable. To the rest of the world, it means that the new thread literally bolts together the biggest collective production capacity in the world. To diplomats, the "Unified Screw Thread Standard" becomes a tangible example of compromise and agreement between nations that they might well follow.

They might begin with a "Unified Standard of Meanings." There are too many words, like "freedom," with differing threads of thought. Words are only the nuts and bolts of ideas. But the world needs unified standards to make the interchangeable parts of peace.

Perry Githerings

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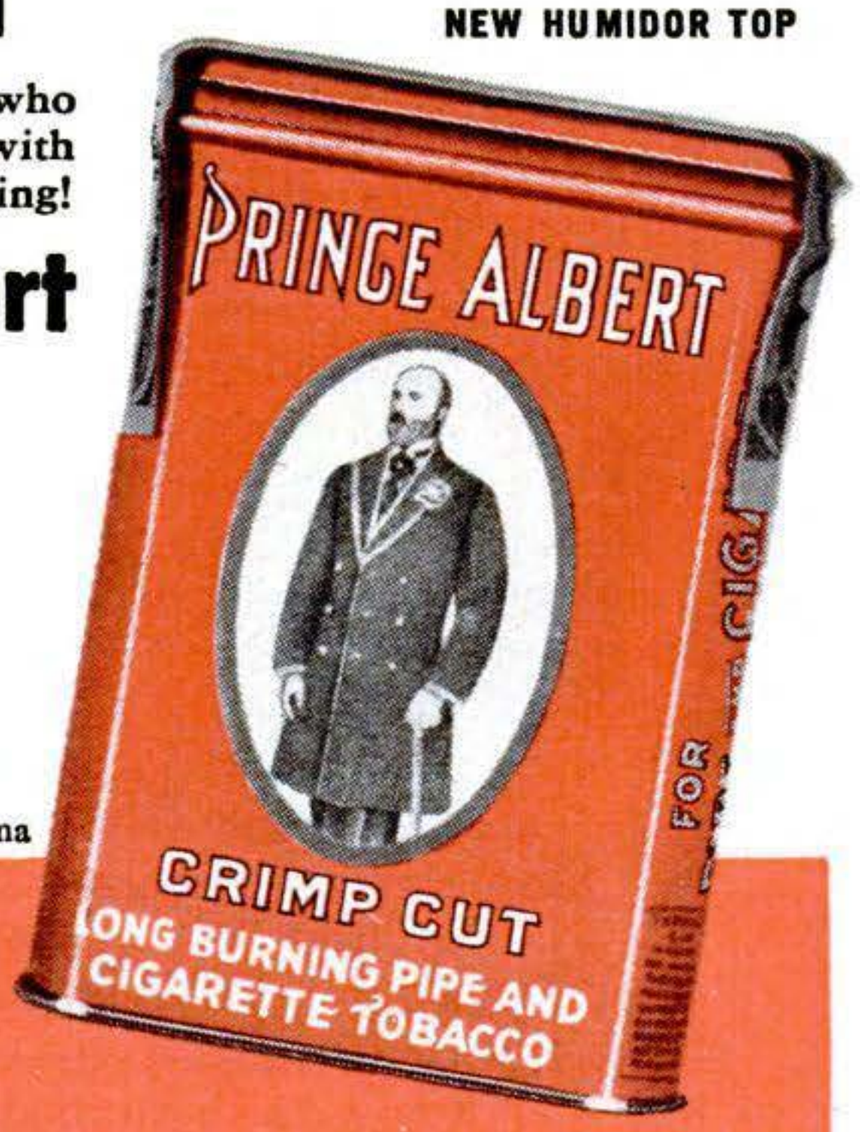
P.A.* means Pipe Appeal

Pipe Appeal is that extra attraction of the man who smokes a pipe. And when that pipe is packed with Prince Albert — you have really smooth smoking!

P.A.* means Prince Albert

NEW HUMIDOR TOP



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THE NATIONAL JOY SMOKE

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Inside Look at Jet Power . . . Here's what gives the big Martin XB-48 multijet bomber a speed close to 500 m.p.h. Above, cowlings are raised for inspection on two of the plane's General Electric, Allison-made J-35 gas-turbine engines. Each produces 4,000 pounds of thrust. Six of these power plants—three in each wing—develop a maximum power greater than that used by two huge electric railroad locomotives each pulling a string of 125 freight cars. The largest multijet bomber of conventional design ever built for the Air Force, the XB-48 has a tactical radius of over 800 miles. It carries a crew of three and has a bomb capacity of more than 10 tons.

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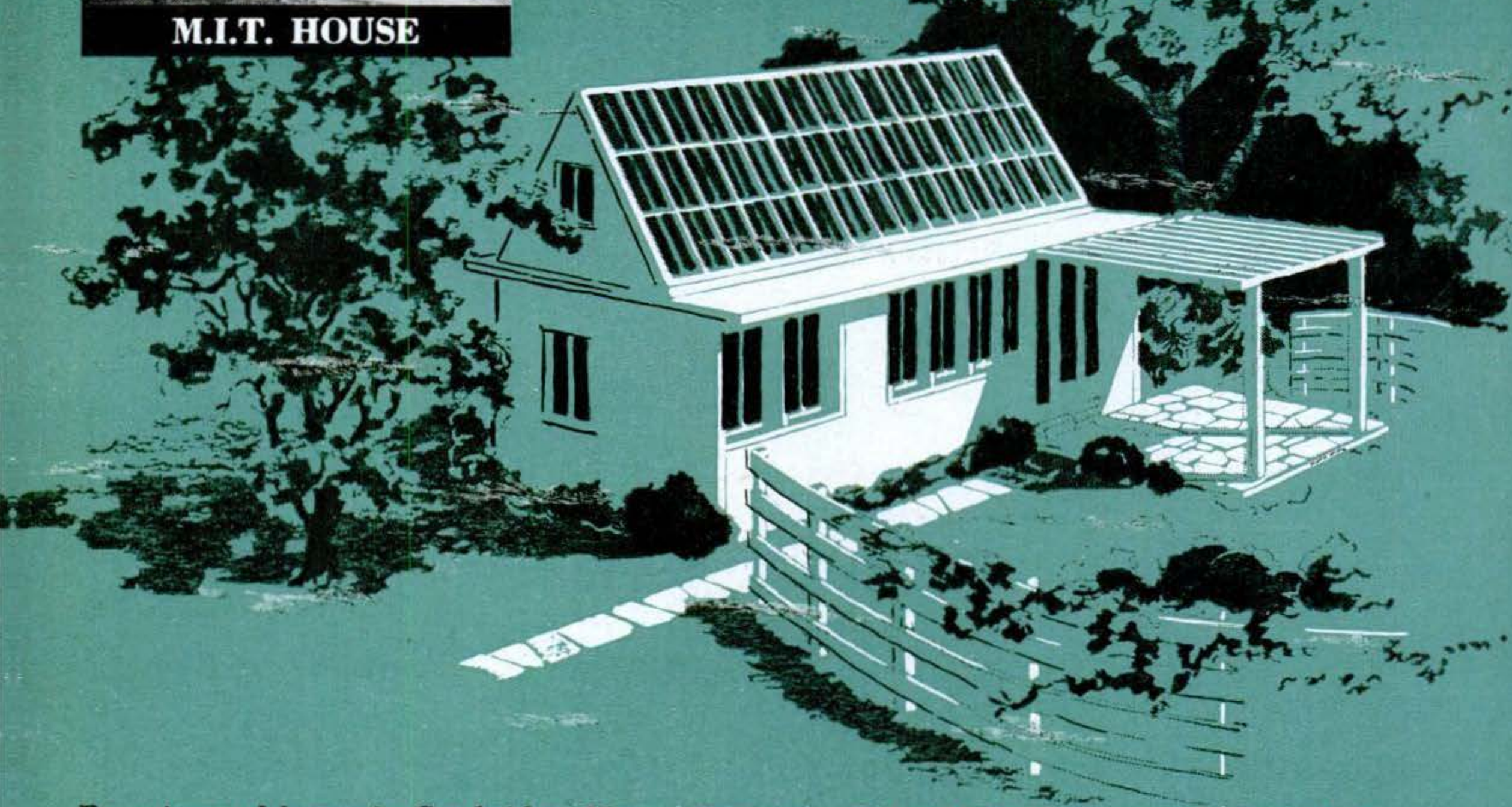
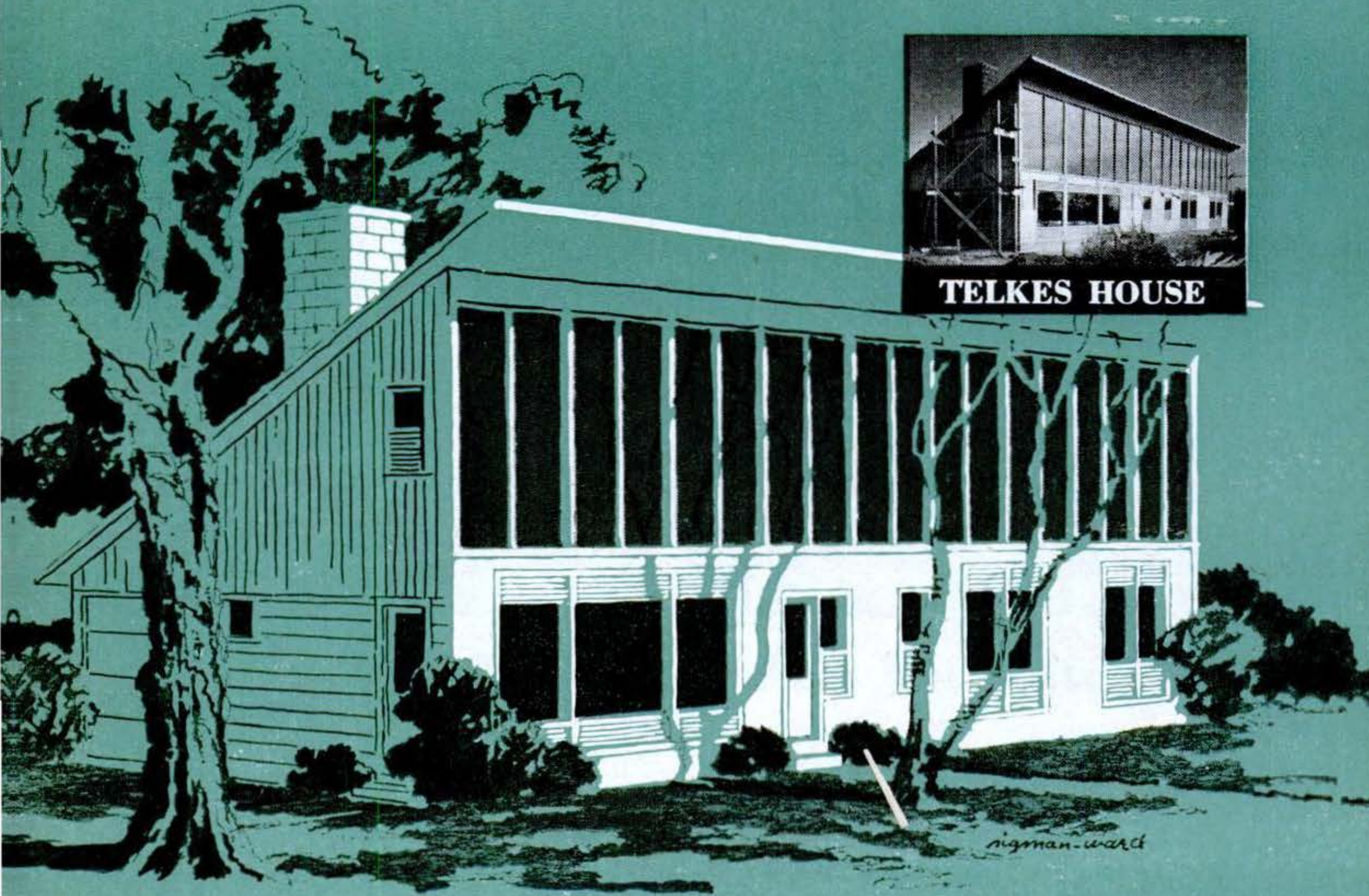
M.I.T. HOUSE



Experimental house in Cambridge, Mass., counts on sun for 90 to 95 percent of winter heat.



TELKES HOUSE

Designed by architect Eleanor Raymond, this house at Dover, Mass., is entirely sun-heated.

Sun Furnace In Your Attic

Cover drawing by Ray Pioch

By Hartley E. Howe

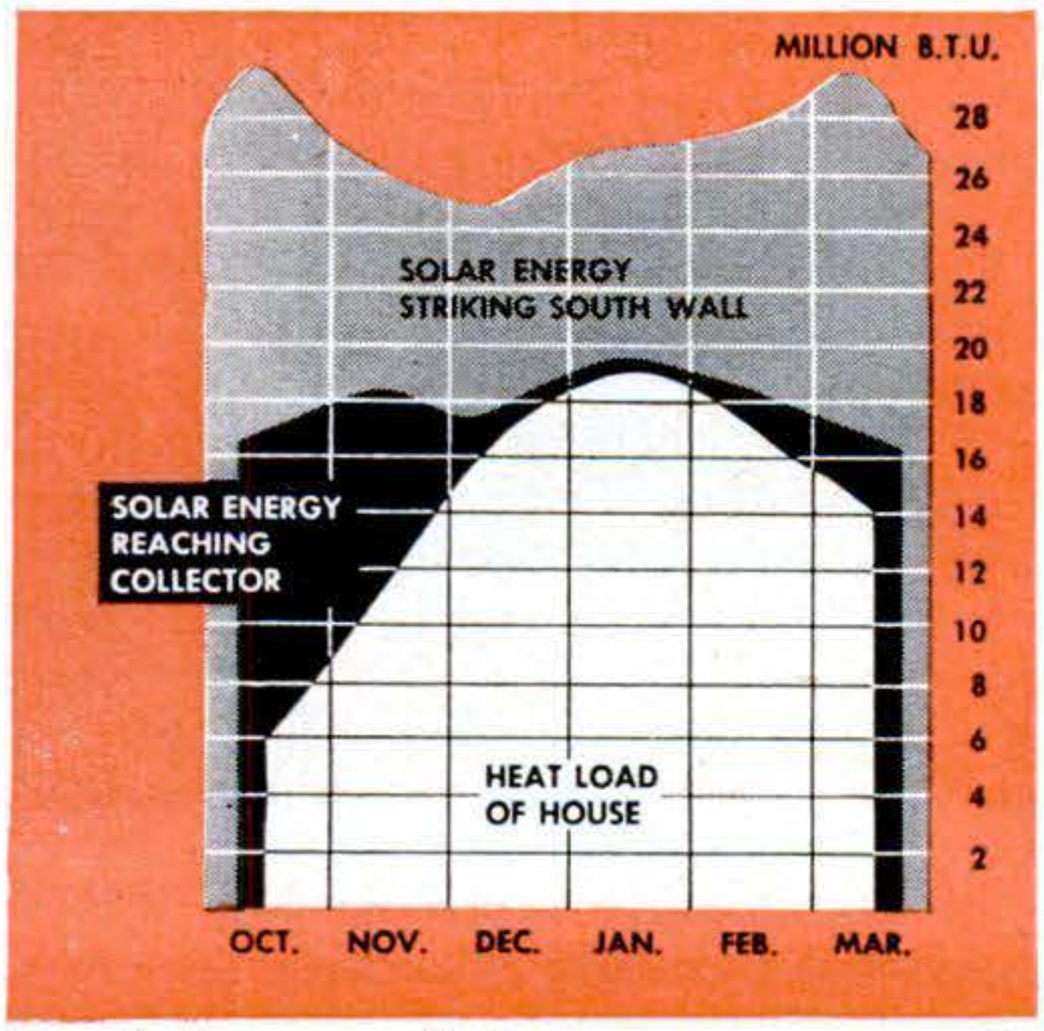
Two houses near chilly Boston may hold the key to economies in home heating and world's fuel supply.

EVERY day, the equivalent of almost two tons of coal per acre falls on the United States. It arrives as visible and invisible light—20,000,000 kilocalories of solar energy. Most of it is wasted.

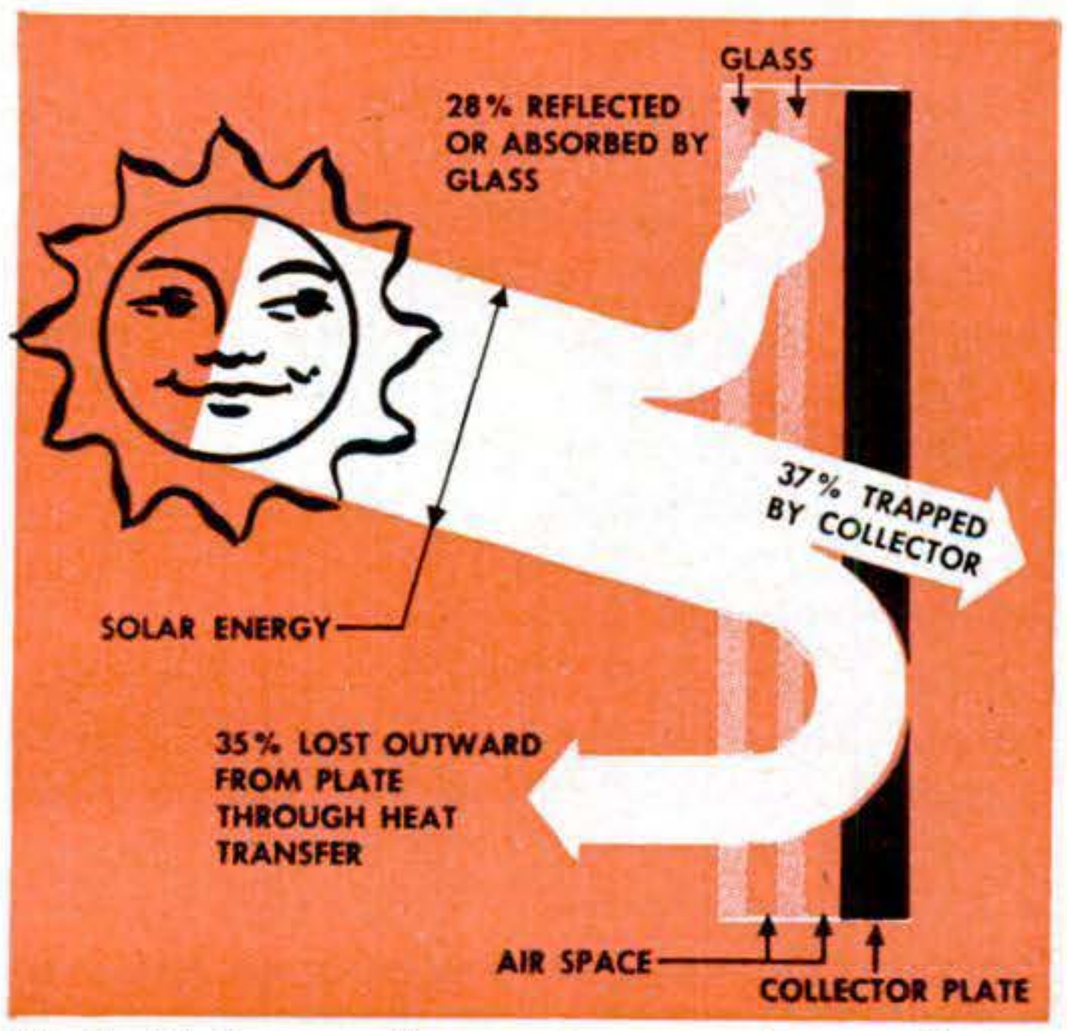
We have reached a point where we need so much energy that we can see the eventual end of our supply of coal and oil. *One third of all our energy goes just to keep us warm.* That's why the two houses on the opposite page may well be two of the most important houses in the world today.

People have been living in these houses this winter without conventional furnaces—in the chilly neighborhood of Boston. They are trying to find out if the sun itself can keep them warm. Do the houses work? We don't know yet for sure. But scientists are banking on it—and success would stretch our fuel supplies for centuries.

To have a sun-heated house, you must solve three problems. First, find a way to trap the sun's heat—or a sizable amount. Second—far more difficult—find a way to



Graph shows margin between average monthly heat demands of Boston house requiring 100 million B.T.U. a year and solar energy trapped by vertical 800-sq.-ft. collector, facing south.



M. I. T. heat collector has two sheets of glass in front of black metal plate. It holds 37 percent of sun's heat for house. Loss outward is included in house heat load in graph at left.

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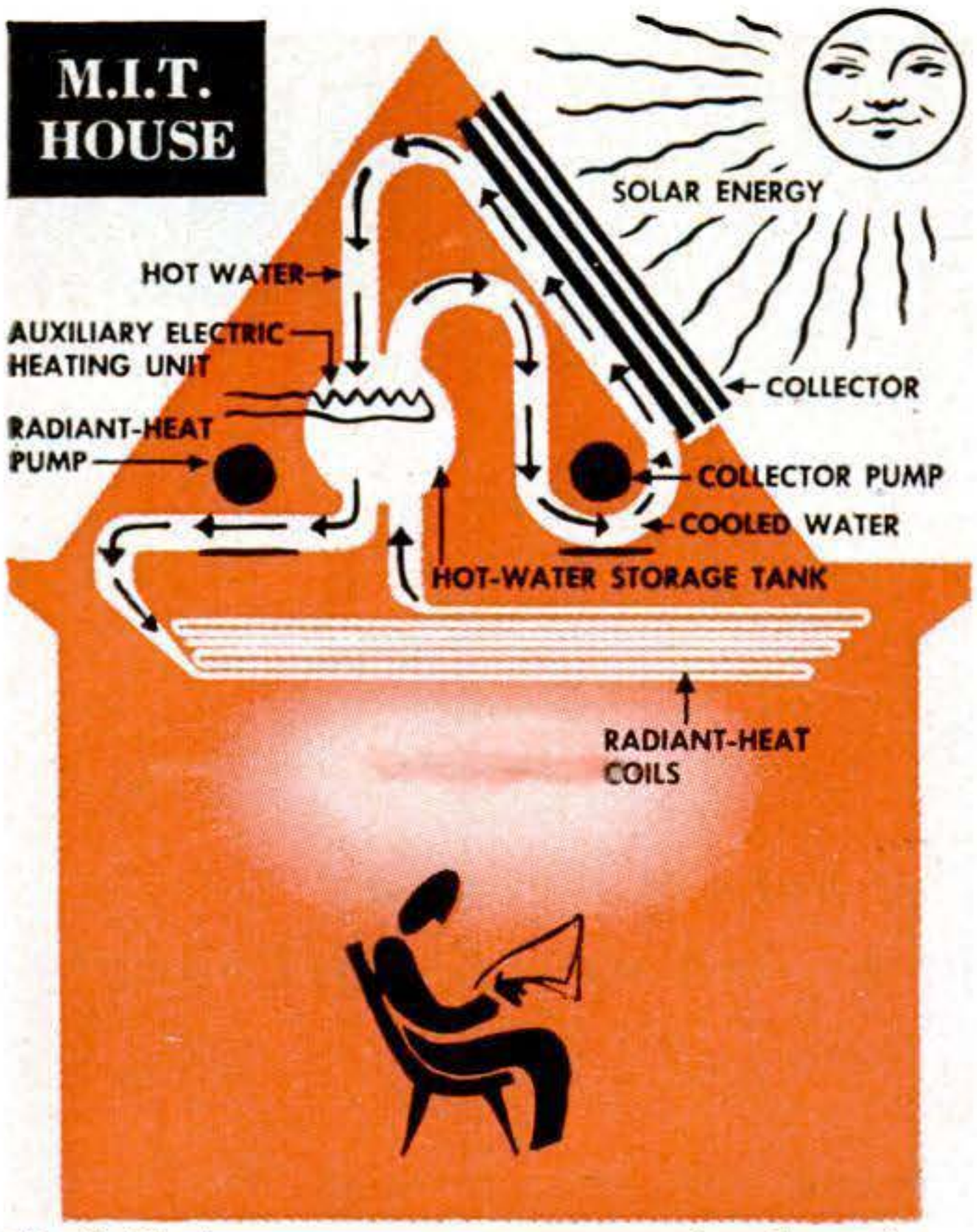
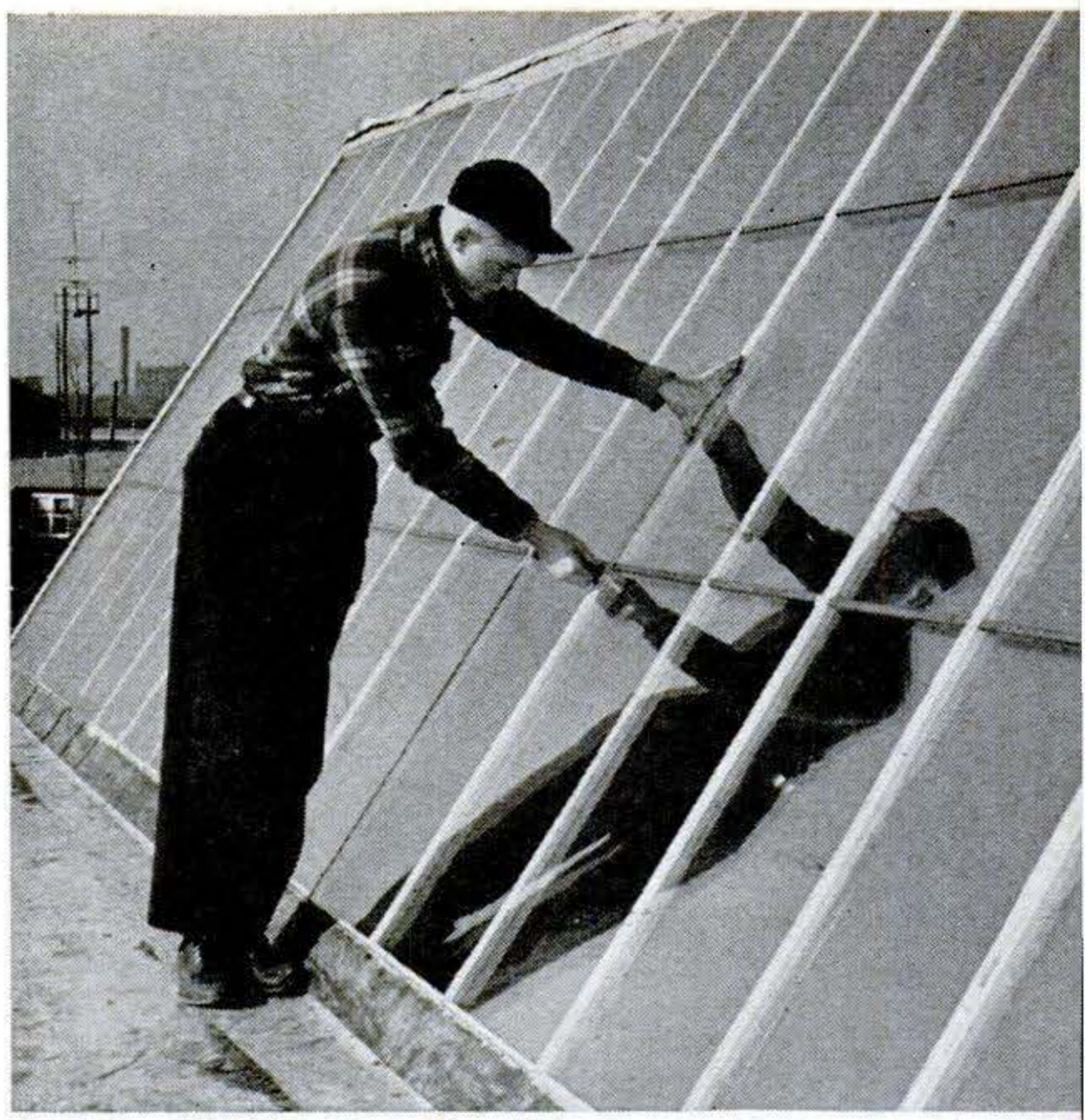


M. I. T. house uses water to gather heat from collector and store it in tank. Electric heater switches on when the house cools below 65° F. Pump circulates water through radiant panels.



Panels of M. I. T. roof collector are set at an angle to get maximum amount of mid-winter sun. Double panes are mounted in rubber. Collector is designed to simplify manufacture.

store peak heat for use at night and in bad weather. Third, do these things with apparatus not too complicated, too bulky, or too expensive. The designers of these two houses think they have all three answers.

Although entirely separate projects, both houses stem from the pioneering Solar Energy Research Project at the Massachusetts Institute of Technology. Here for the past 12 years an endowment by Dr. Godfrey L. Cabot has enabled scientists to explore ways in which man can better use solar energy. One of the new houses was built by the project itself as its latest experiment. The other was privately financed, by Miss Amelia Peabody of Boston, for the sun heating system developed by Dr. Maria Telkes of the M.I.T. faculty, long with the Solar Project.

In both houses, the trap that catches solar energy is the collector devised by H. C. Hottel and B. B. Woertz of M.I.T. This makes use of a fact familiar to every greenhouse owner: you can catch sunlight under glass. The very short energy waves from the sun go through glass comparatively easily and heat what they hit. The long heat waves from the hot object, however, do not penetrate glass easily and are trapped behind it.

In the Hottel collector, two 7/32-inch glass plates, with a ½-inch air space between them, cover a sheet of black-painted metal. About 37 percent of the energy that strikes the outer surface is trapped by the sheet.

If left in the metal plate, much of this energy will be lost outward during the night. This is why the widely known "solar" house with its big south windows must depend on a furnace for its main heat source; it heats up well on sunny days, but rapidly cools as it loses heat outward after dark. A true sun-heated house must store the heat —not only for a night, but for days at a time during bad weather. What is needed is the equivalent of a storage battery; something that will soak up the heat on bright, sunny days, and hold it for later use.

Bricks, scrap iron, and marble hold heat reasonably well. Some of them can be used in the walls. But the limited amount that can be built into a house will not hold enough heat. More hopeful is water. A cubic foot of water will hold 62.5 B.T.U. for every degree Fahrenheit its temperature is raised. Water weighs a lot less than iron or rock, and can be piped to carry the heat where needed. That's why water has been widely used in heat storage equipment.

Glauber's salt, a chemical used in photog-

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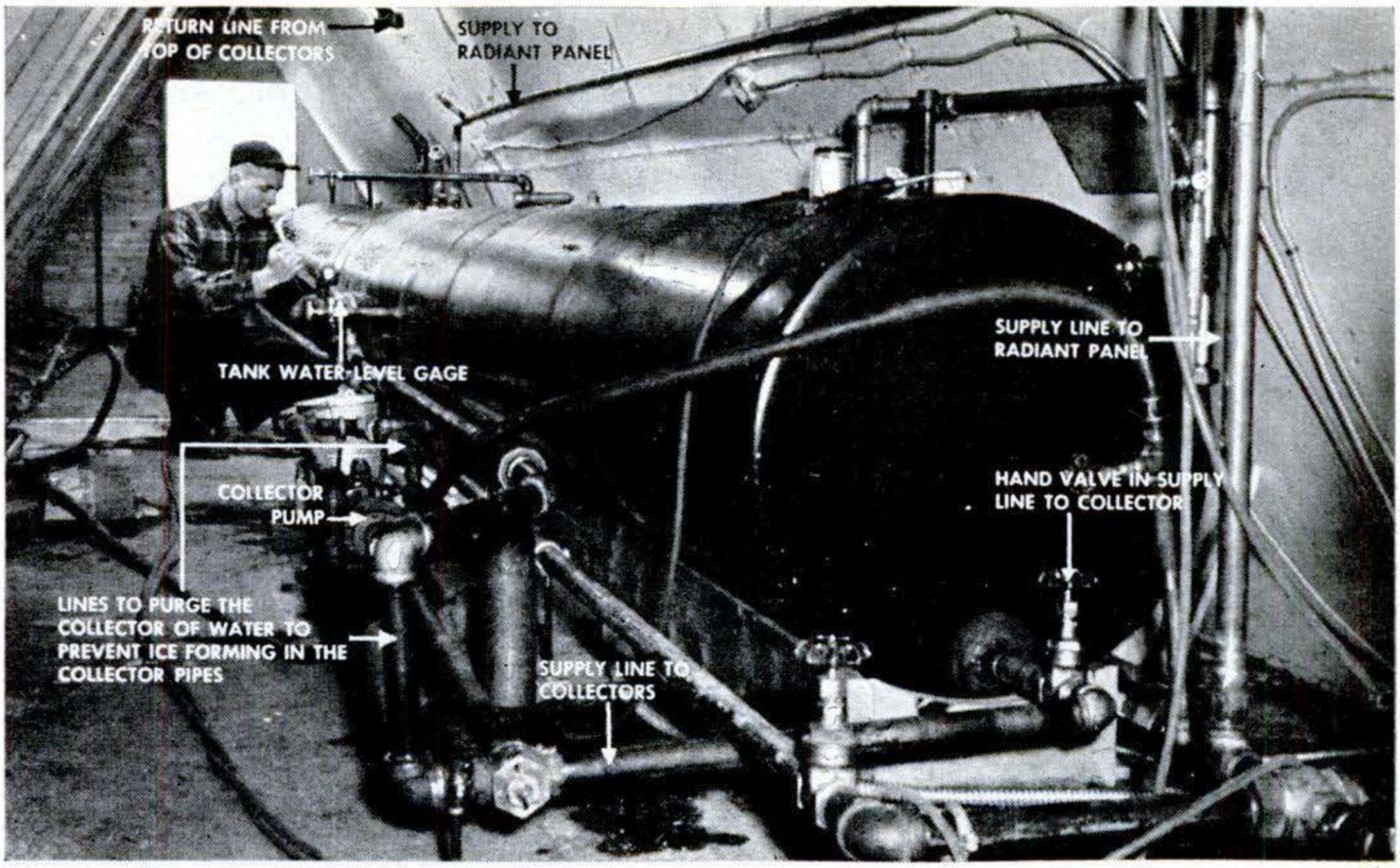
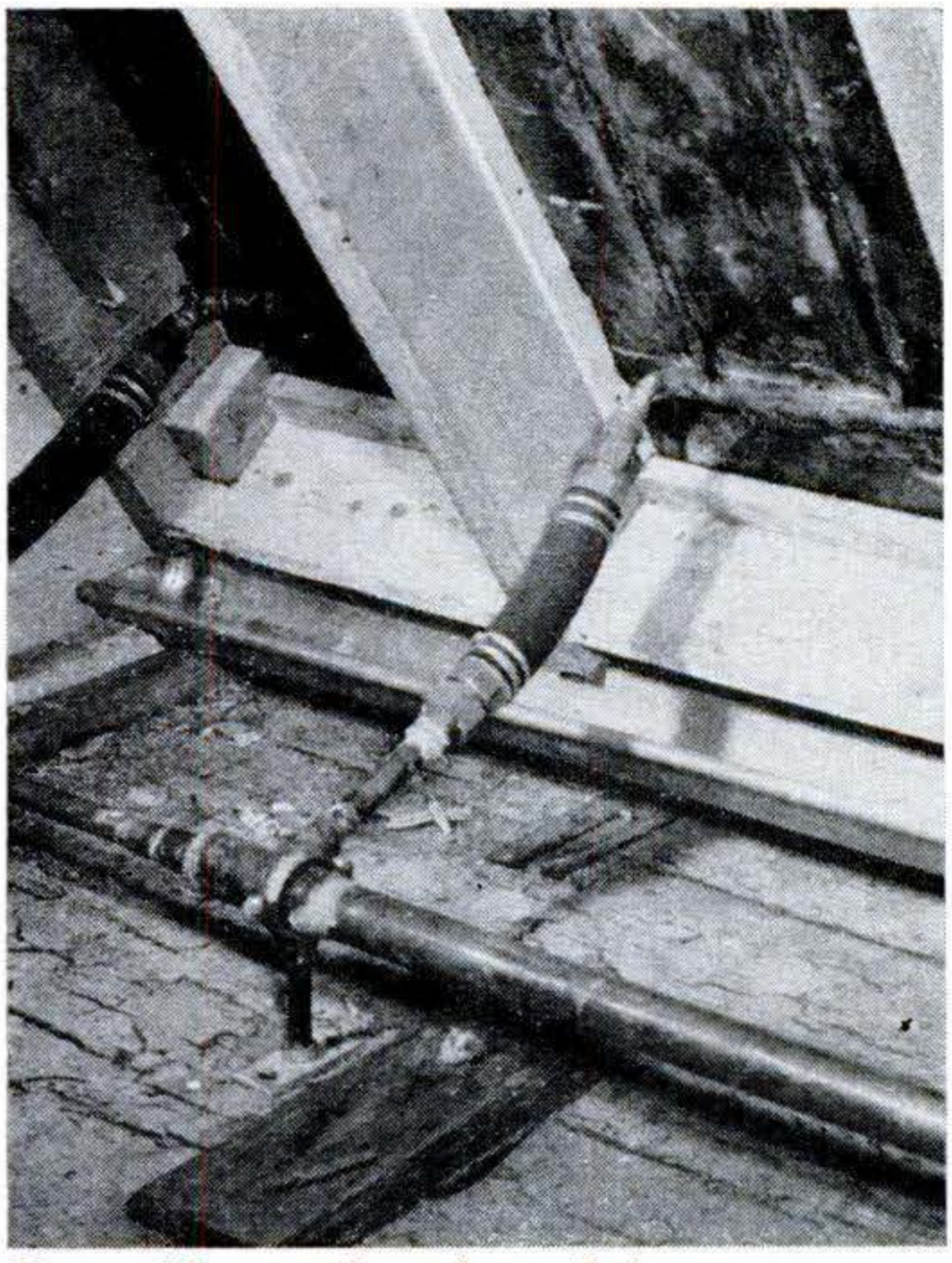
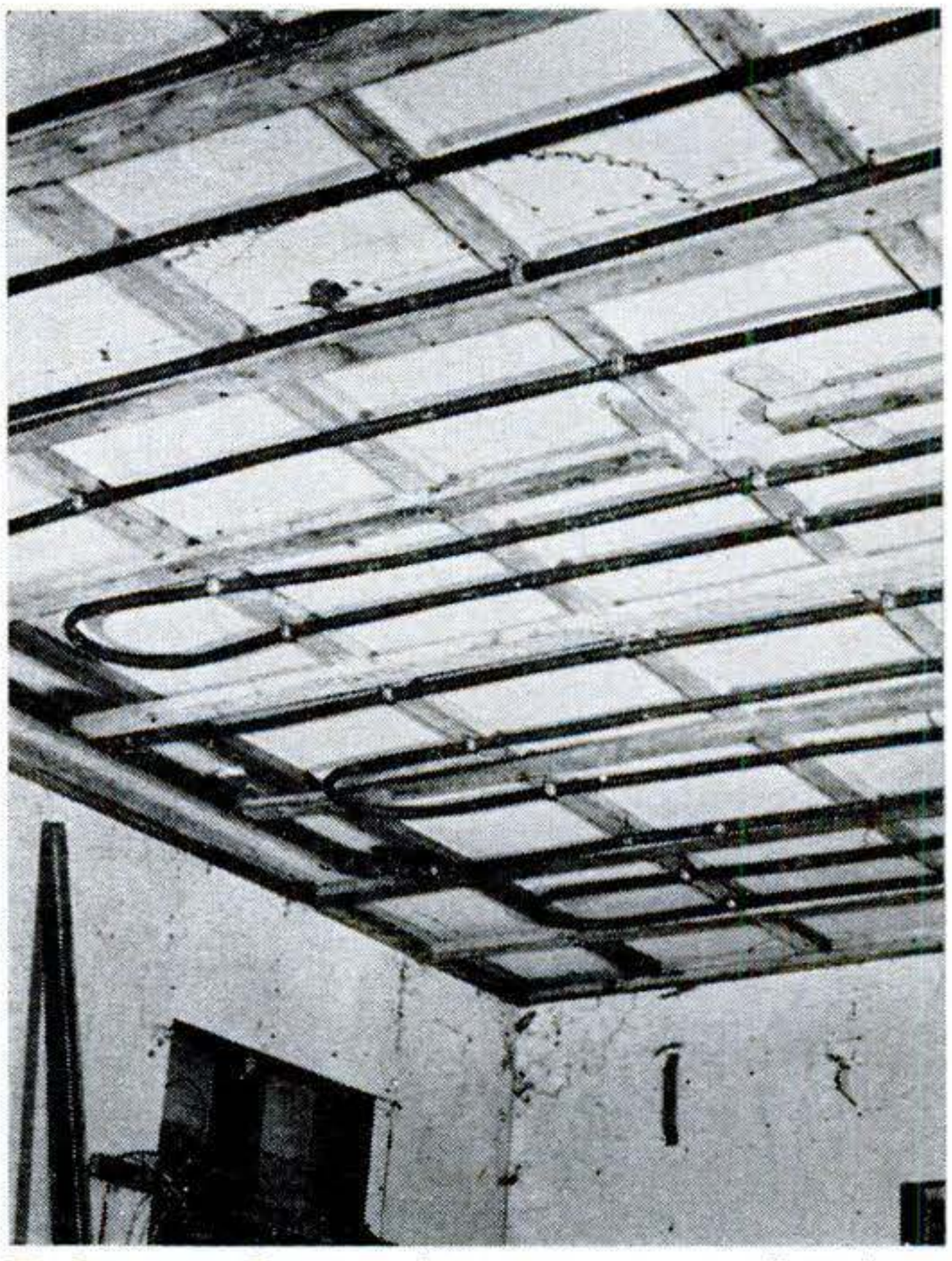


View inside attic of M. I. T. house during construction shows 1,320-gallon tank that stores water heated by collector. Return connection at top left is still incomplete in picture. Pump that circulates water through radiant-heat panels in ceiling below is at far end, hidden behind workman. This pump is run by 1/16-hp. motor; separate pump for collector system, by one of ¼ hp. Tank contains 1,200 gallons of water, leaving air space at top. Total weight of tank and water is six tons. To prevent loss of house heat, attic is insulated from rooms below. They contain 680 square feet of living area plus 60 square feet for instrument room.



View of lower edge of panel shows connection with bottom pipe that feeds tank water to pipes running up collector. The back of the panel, here exposed, is insulated in finished house.



Radiant coils in ceiling are connected to hot-water tank in attic above. Radiant system has its own circulating pump. Other hot-water types of heating could probably be used if preferred.

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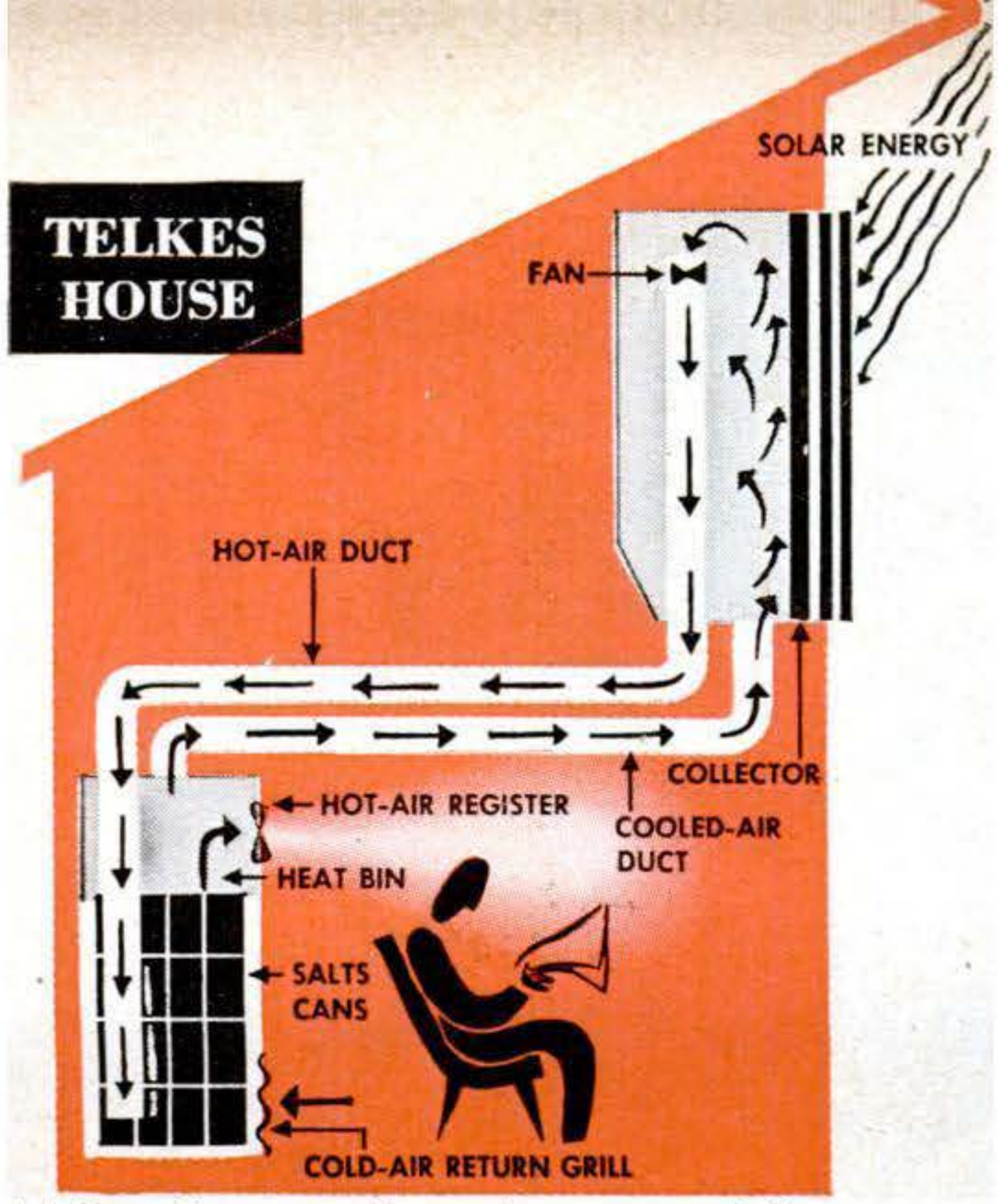
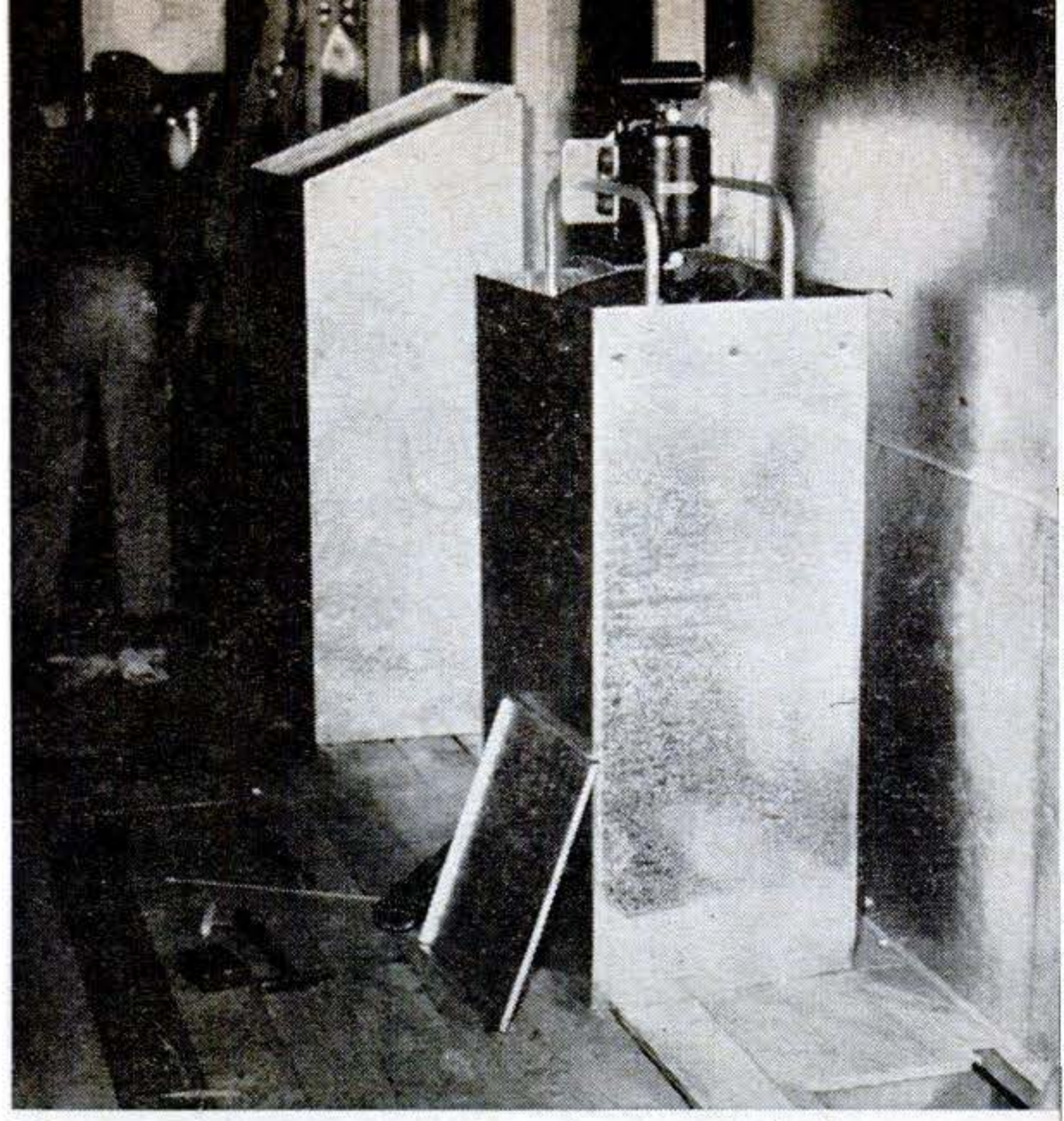


Telkes house collects heat at roof but stores it below. Storage bins of Glauber's salt are heated by air. They can be at back of room, as in diagram, or in partition closets.



View during construction shows metal ducts in attic that circulate air between collector and bins below. In finished house, ducts are hidden by insulation, since attic is not heated.

raphy and dyeing, will store even more heat. It melts at 90° F. and in so doing absorbs 9,500 B.T.U. per cubic foot. When it recrystallizes, it gives this heat out again. Counting in the B.T.U. it can absorb before and after melting, the salt can soak up about seven times more heat than water. It tends to remain near 90°, a useful level for house heating, is comparatively cheap, and can be easily stored in metal cans.

Because of these advantages, Dr. Telkes uses Glauber's salt in her sun heating system. This has been built into a two-bedroom country house in Dover, Mass., outside of Boston, where its stark modern lines stand out in the New England countryside.

The collector, faced with inexpensive figured glass, forms a blind second story on the front of the house, which faces due south. The vertical collector is less efficient than one set at an angle, but it's less likely to catch snow and sleet. Besides, the overhanging roof keeps sunshine off the collector in the warm months.

An insulated wall three inches behind the collector plates of black-painted sheet steel makes an air space. The air is blown through this space, absorbs heat from the plate, then passes to salt-filled heat-storage bins below. Here the air circulates around the cans of salt, surrenders its heat to them, and returns to the collector for reheating. This circulation is continuous so long as enough solar energy is being received to keep the collector hotter than the cans. A fan register in each room warms the house.

Because of the high heat-storage capacity of the salt, the Telkes house has no other heating system. Dr. Telkes estimates that the cans hold enough heat for at least ten consecutive days of bad weather. Records show that even in Boston six consecutive days of below-average sunshine occur, on an average, only once in every 14 years.

The vital point—and one on which it is too early to have a definite report—is whether the Glauber's salt will absorb heat with its theoretical efficiency. According to some reports, the salt tends to stratify and lose much of its ability to absorb heat. Dr. Telkes is confident, however, that proper installation and use of the salt will overcome this problem. She has been living in the house herself since Christmas.

The M.I.T. house uses water as its storage agent. Since water is only a moderately efficient means of collecting calories, a lot of it is needed. Enough to carry a house through the worst of the winter would require an enormous, expensive tank; so this house doesn't depend entirely on the sun.

To obtain as much solar energy as possible in mid-winter, the collector-roof is set at an angle. The copper collector plate is ribbed every six inches by a vertical pipe, soldered to the back. Water pumped through

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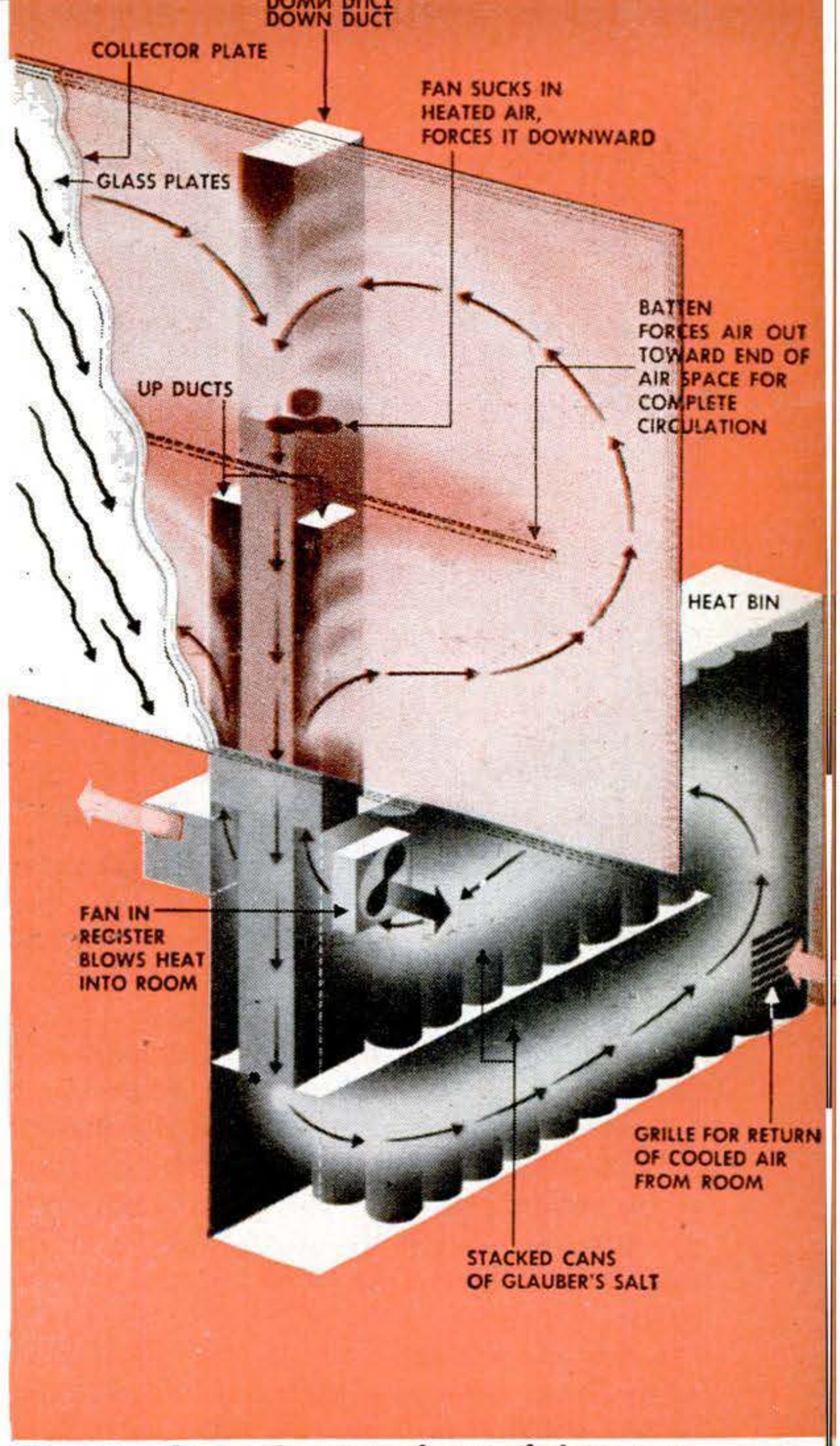
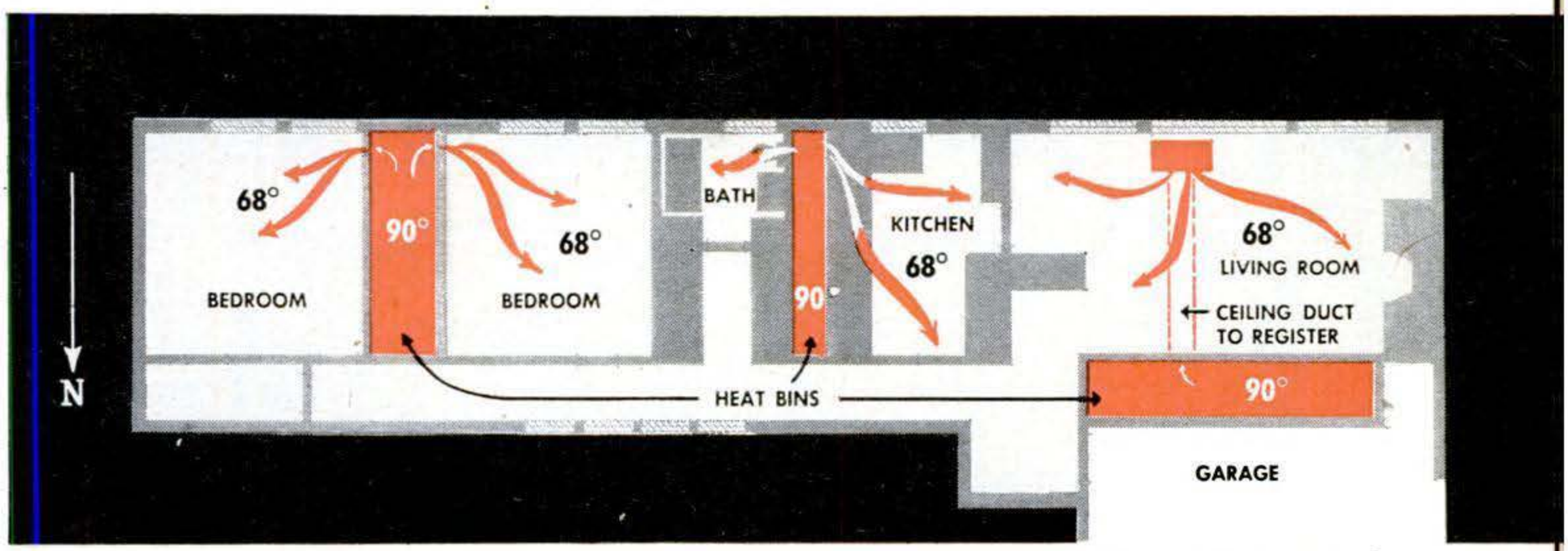
View of inside of bin shows stacked cans of Glauber's salt that actually store the heat. Closetlike bins are closed off from rest of house and need to be opened only for adjustments.

these pipes carries away the heat from the plate to a tank, the water circulating continually as long as the collector is at least 5° hotter than the tank water. When darkness or heavy clouds cause the collector to cool, the usual flow from tank to pump to collector is shut off, while another circuit from collector to pump to tank opens automatically. Thus the nonreversible pump can drain the collector, leaving empty pipes that will not freeze or pull heat from the tank.

A second electric pump circulates the heated tank water through the radiant heating coils in the ceilings of the room below.



Drawing shows close-up of one of three two-story collector-storage units in Telkes house. Wall fans and grilles blow out hot air into top of rooms, let cooled air return from bottom.



Plan of house using Telkes system, designed by Boston architect Eleanor Raymond, shows how heat bins are sandwiched between rooms or placed at back. Long hall with minimum of windows on north side helps minimize heat loss. Fireplace is only conventional heating unit; and it's for pleasure, not utility. Whole house is heavily insulated against New England winter.

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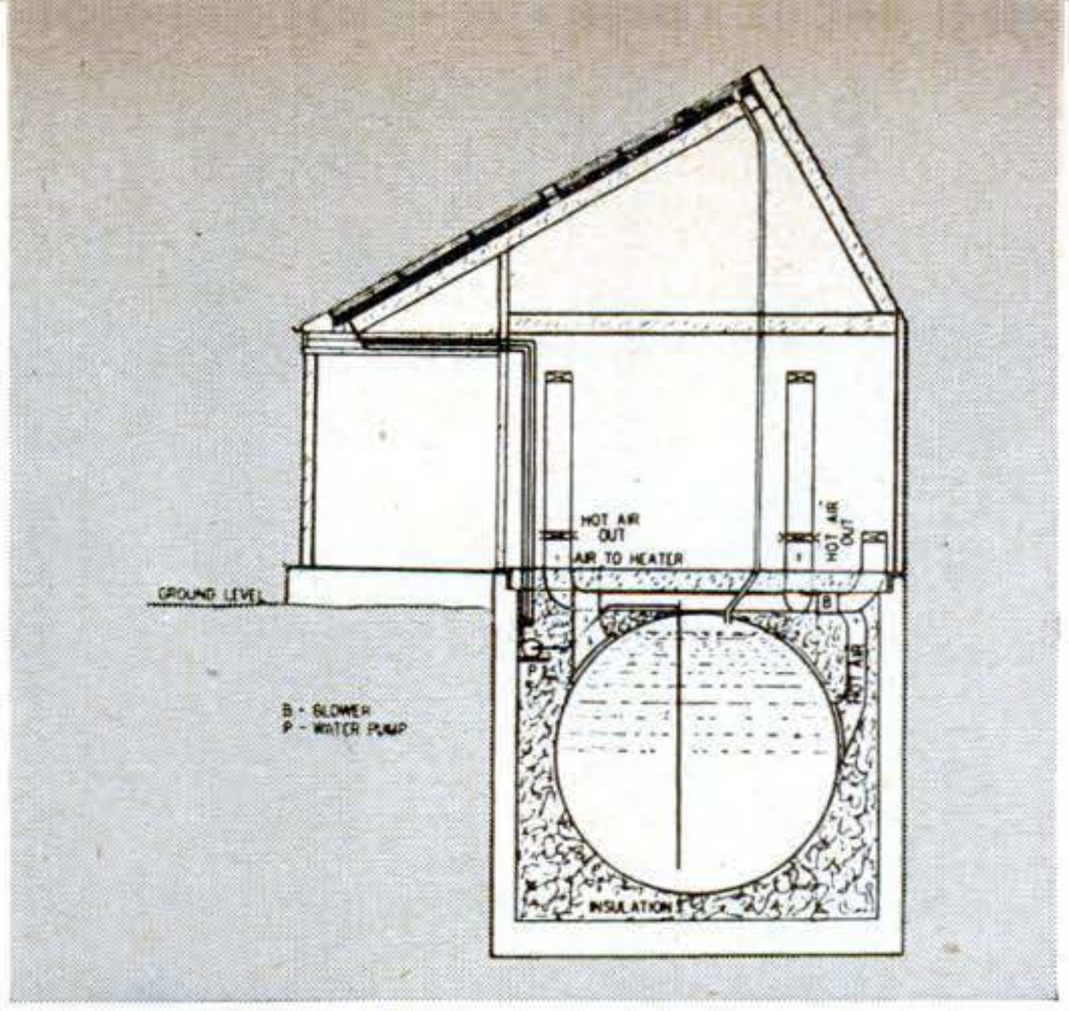
First M. I. T. sun-heated house, shown above, was 31 by 18 feet. It held lab, small office. Collector plates were similar to those now used, but water was piped to cellar tank.



Cross section of first M. I. T. house shows how 17,400-gallon tank filled huge cellar. It held water warm all winter, but cost made system uneconomical. Air warmed by tank heated house.

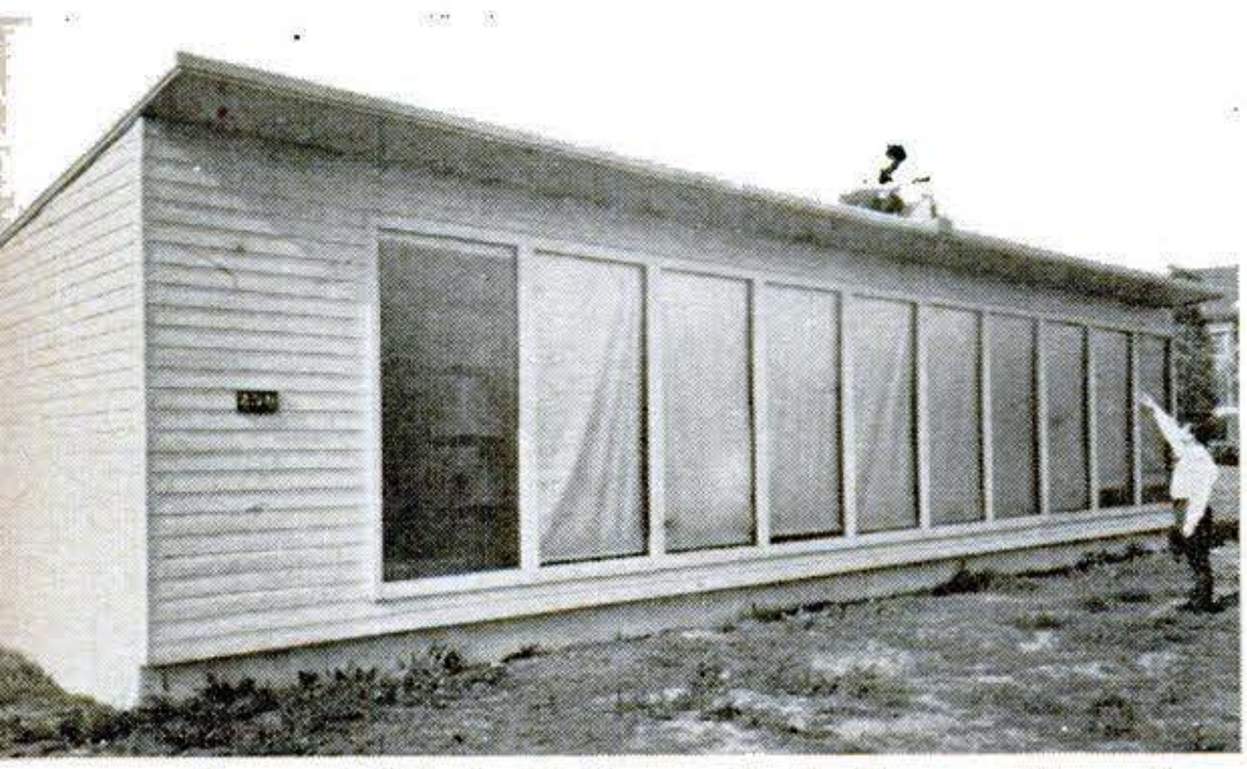
If a long spell of bad weather should drop the house temperature to 65° F., an electric heating unit in the tank switches on automatically. However, Edmund L. Czapek, M.I.T. research associate in charge of the project, predicts that the auxiliary unit will be needed only 5 to 10 percent of the time.

Assuming that both or either house works, how much does all this mean to the average householder? It depends on how easily costly apparatus could be redesigned for mass production. The Telkes heating unit is estimated to have cost about $3,000. No exact cost figures are available on the M.I.T. system. Both houses are expensively insulated. It is estimated that Boston, with some 105 clear days a year, is farthest north for practicable sun heating. Beyond that, the collector gets too big for the house.

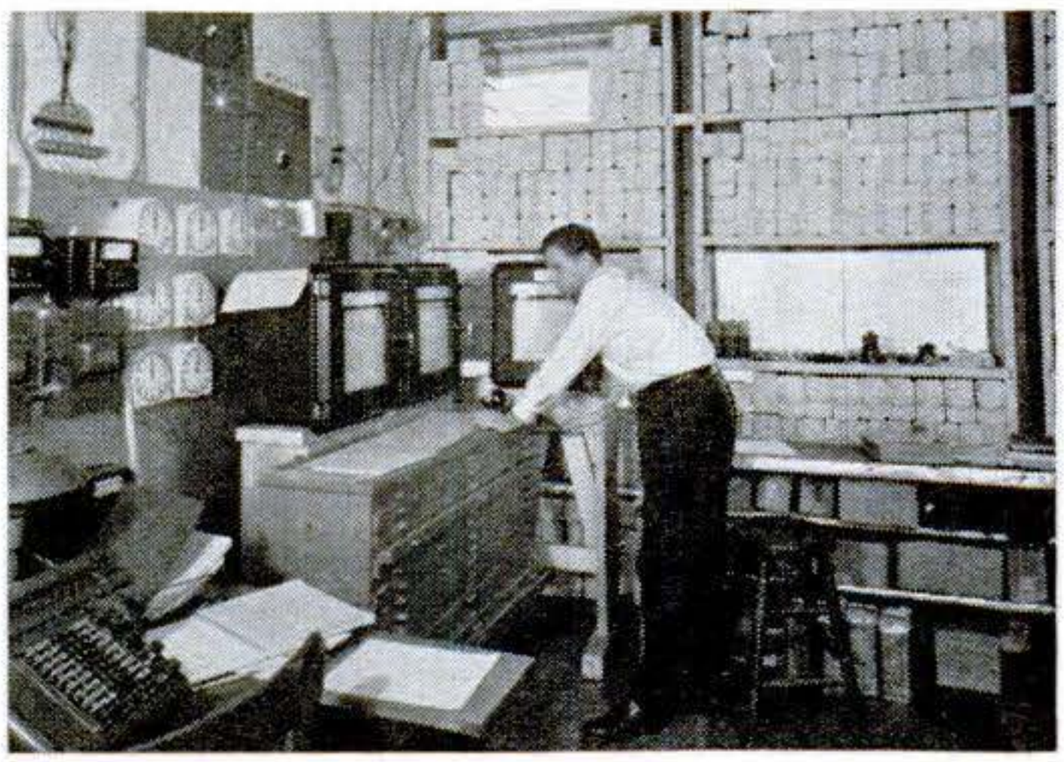
Other methods of using solar energy—photosynthesis, thermocouples, photoelectronic cells—are being studied at M.I.T. and all over the world. But right now, house heating is the most hopeful. Eugene Ayres of Gulf Research and Development estimates that if we could harness the sun to do just one-half the space heating we need, world consumption of diminishing fuels would be cut by 4.5 trillion horespower hours per annum. He thinks this is quite likely to happen during the next 100 years.

A house cannot compete in drama with the towering cloud of death that rose over Hiroshima. Yet the sun furnace may be the more important portent of the two.

The energy released by the atomic bomb is matched every day by the sunlight that falls on 1½ square miles of land. The world's supply of uranium and thorium—the only two elements at present potential sources of atomic energy—are definitely limited and nonrenewable. In contrast, the energy locked into sunlight is far greater. And it renews itself at dawn each morning. END



Second M. I. T. house had glass south wall as collector instead of roof. This view shows insulated curtains down to prevent loss of heat **outward** at night and during bad weather.



Inside view of second M. I. T. house shows how cans of salts were stacked behind glass south wall to store heat. Research associate E. L. Czapek is shown studying recording instruments.

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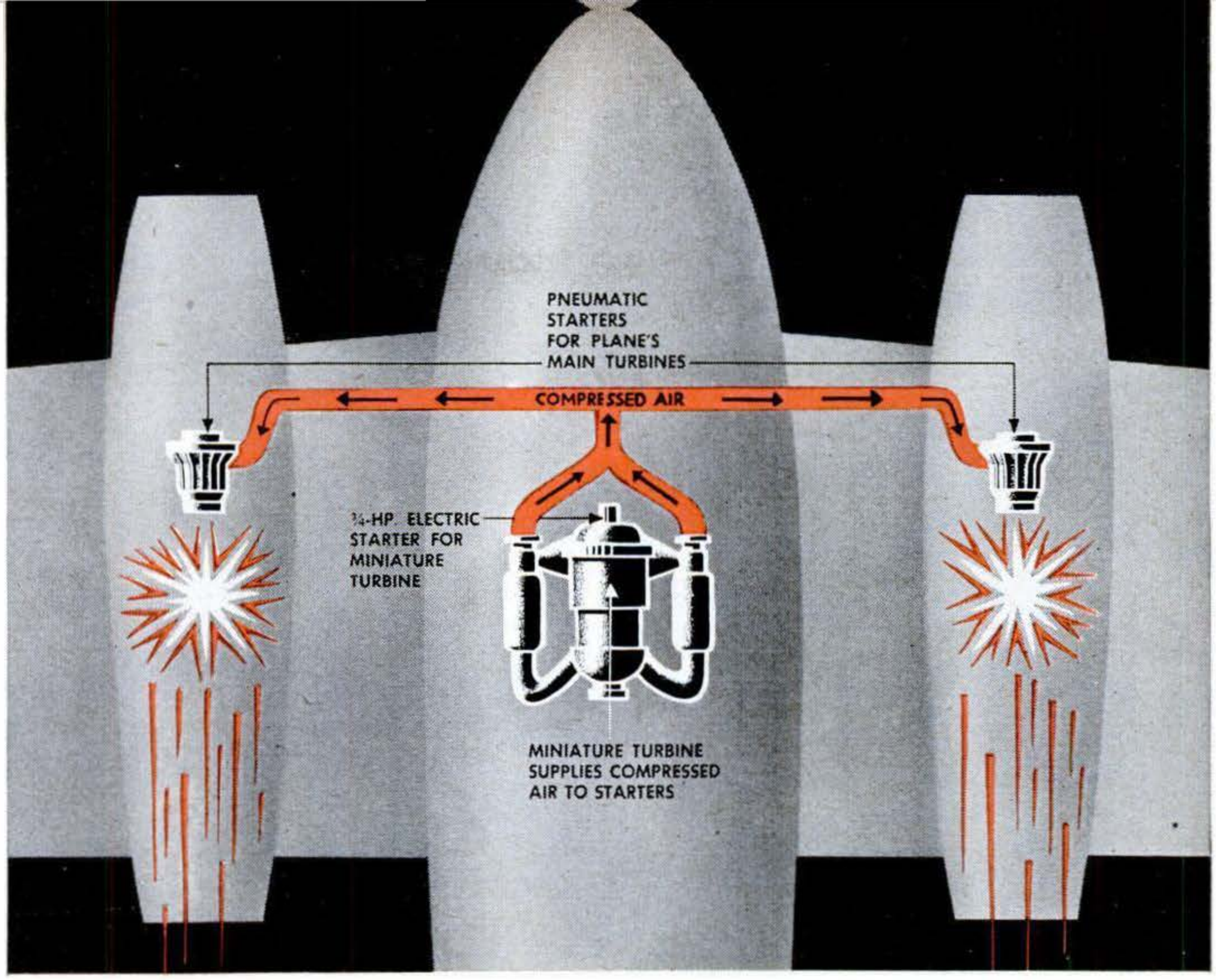


Tiny Turbine Twists Jet Starter

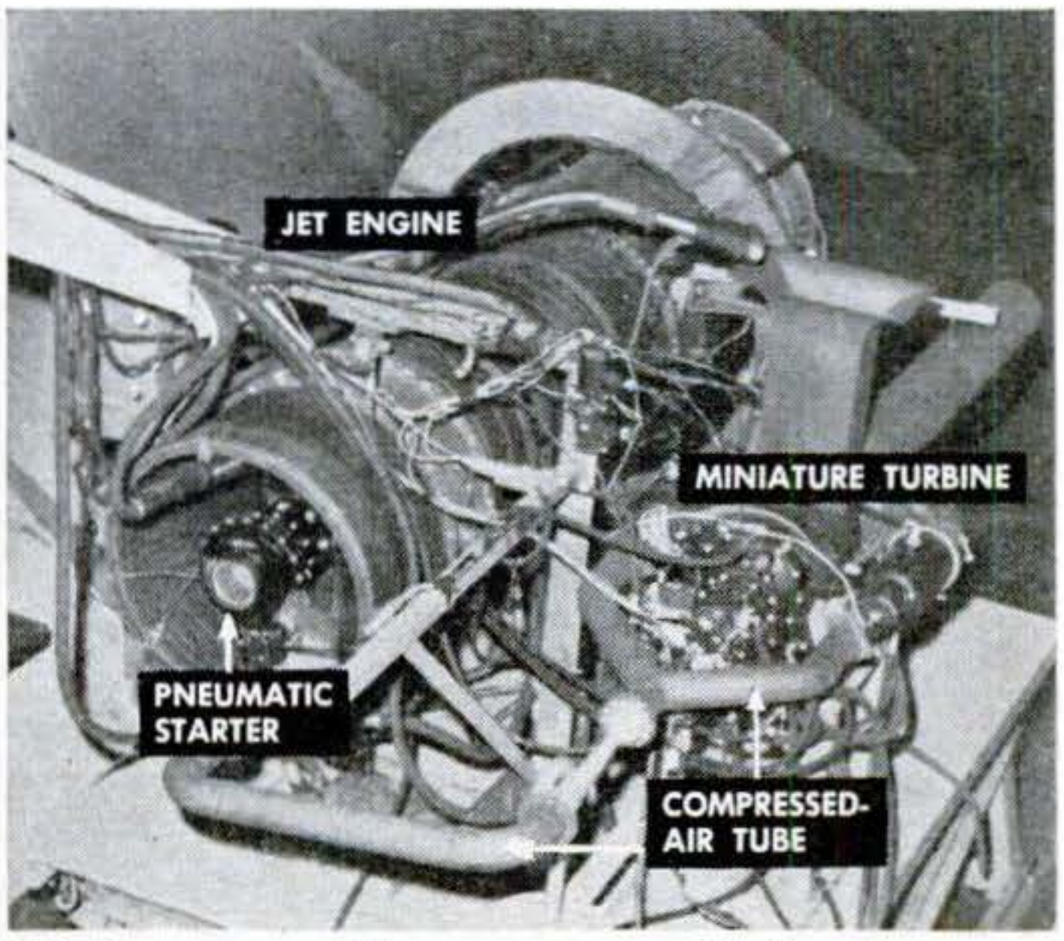
IT takes a powerful twist to start a jet's engine. The air compressor must be spun until it builds up a high-pressure fuel mixture that is ignited by an electric spark—and the jet blast roars.

Built-in electrical starters will do the trick in an emergency, but they put a punishing load on the batteries: if the engine doesn't catch the first time, you're stuck. Usually, starting on the ground is done by wheeling up storage batteries or other heavy auxiliary power units.

Now the Navy thinks it has the answer in a new 88-pound self-starter developed by the AiResearch Manufacturing Co. Actually it's a pint-sized gas turbine that is kicked over, at the touch of a button, by its own ¾-hp. electric starter. Spinning at 40,000 r.p.m., the unit supplies compressed air to a pneumatic starter attached directly to the main jet engine.

The entire starting system weighs only 104 pounds, as compared with 220 for an electrical starter plus batteries.

Although engineering problems will not permit its installation in current models, the Navy plans to build the new starter into two future jet planes. END



Miniature turbine starter unit is shown at right above in demonstration installation. Piping shows how compressed air is bled off to run pneumatic starter on main engine.

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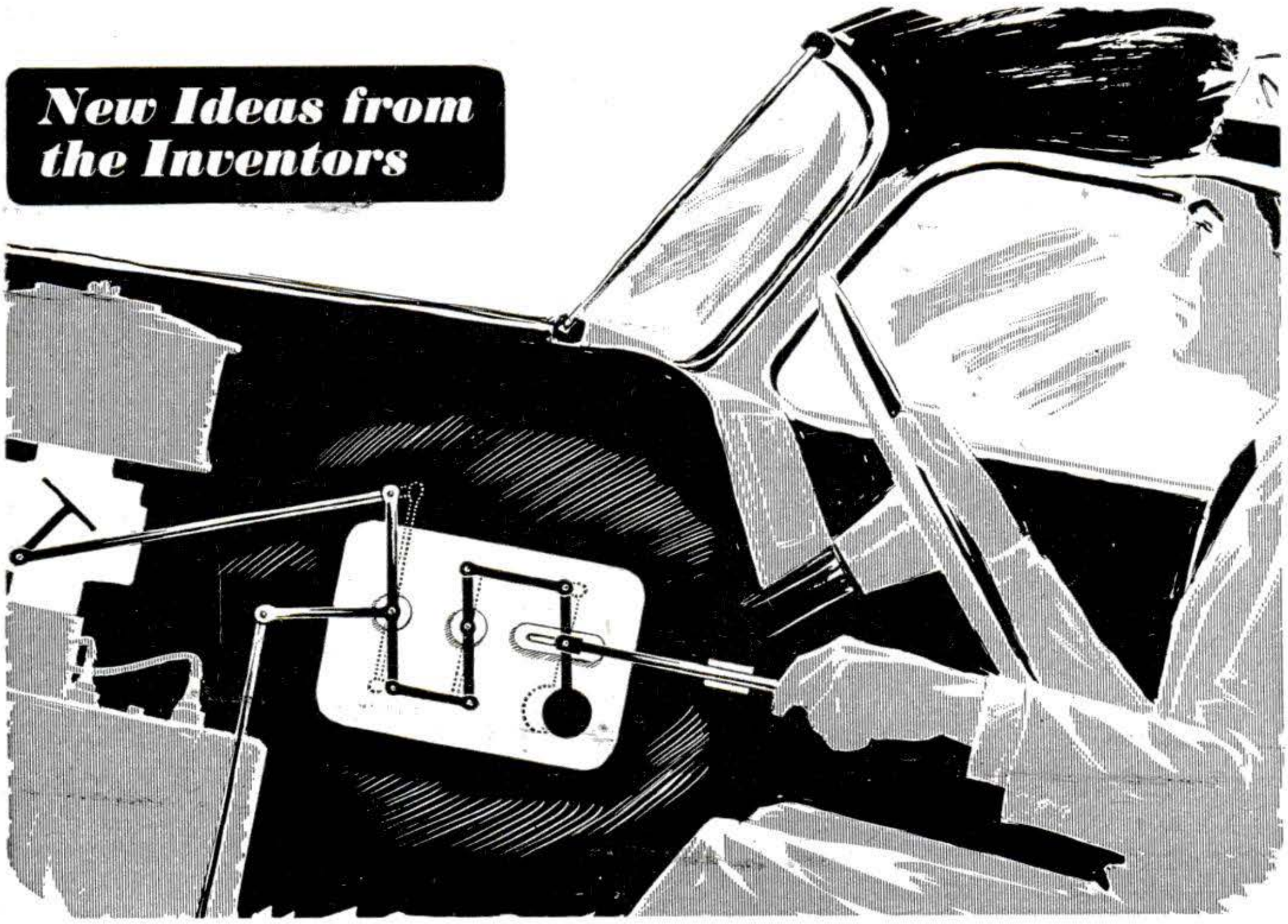
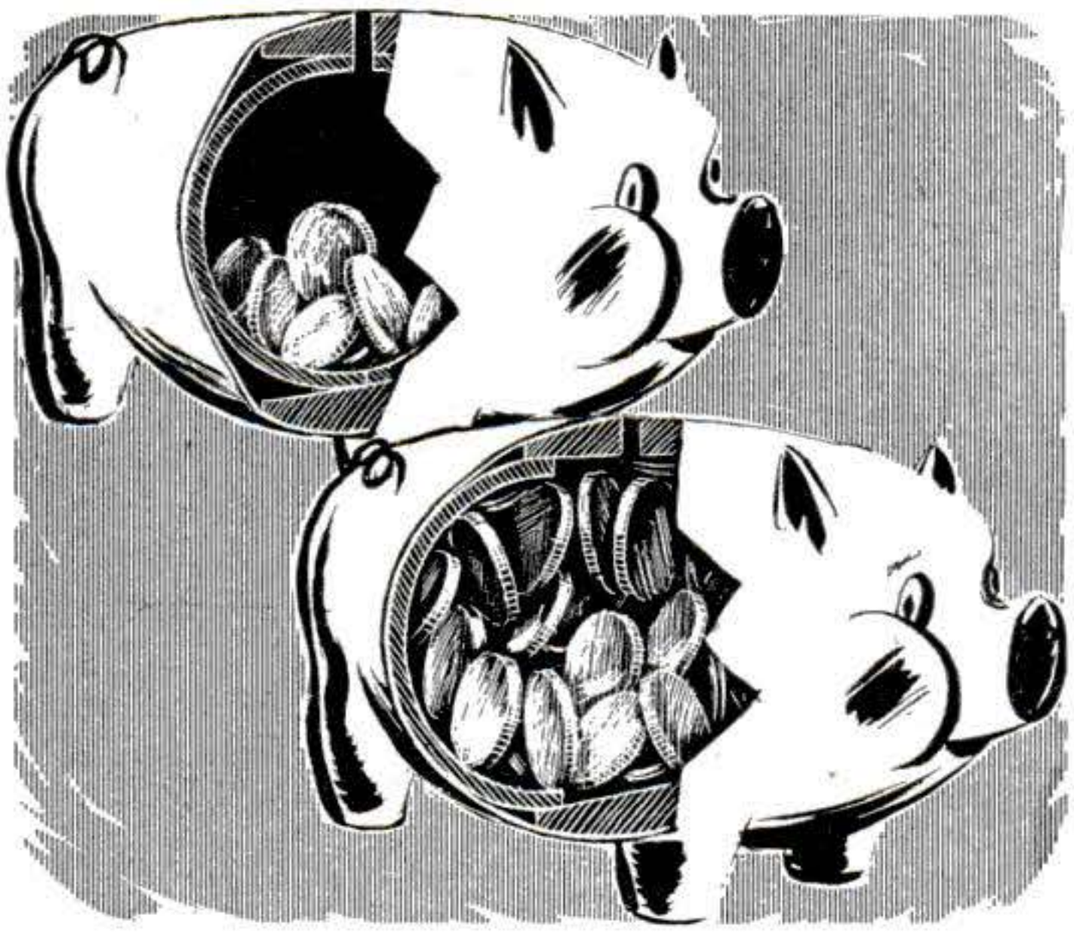
New Ideas from the Inventors



Pendulum Controls Car Speed. A weighted pendulum does the work of your accelerator foot in the invention of P. J. Burchett, of Glendale, Calif. Connected to the accelerator control rod, it swings backward on an upgrade to increase power and forward on a downgrade to decrease it. Braking also throws it forward, reducing speed. A hand throttle sets the speed. The accelerator can be used independently.

Shoe Has Hinged Heel. You wouldn't have to struggle with shoehorns or laces to get these novel shoes on. The back part, hinged at the heel, swings open to let the foot slide in easily. Snapped closed, it provides a snug fit without any fasteners. A spring clamp locks the heel in place. The inventor is J. R. Napton, of Marshall, Mo.



Coins Fatten Piggy Bank. Children might get more fun out of saving their pennies with this expanding piggy bank. As the coins pile up inside, they gradually push apart the two sides of a split, spherical container. These force the elastic sides of the pig to bulge outward. The bank was invented by J. W. Kimball, of Athens, O.

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Bucket Dumps Itself. No motors or winches are required to operate this bucket. Pivoted near the bottom, it is top-heavy when filled. When a release cord is pulled, it automatically tips over, dumping its contents. When empty, however, its weighted bottom returns it to an upright position, ready for the next load. Invented by G. H. Johnson, of Rockford, Ill., it can be lowered into floor pits for easy filling.

Ladders Make Scaffold. These Z-shaped brackets are designed to convert two ordinary ladders into a safe and simple scaffold. Invented by T. E. Graham, of Oklahoma City, they hook onto three rungs of each ladder and support a plank across them. Their Z shape distributes the pressure over three rungs and prevents slipping.

Waste Can Smothers Fires. A fire wouldn't last long in the waste basket patented by D. A. Florence, of Philadelphia. When one starts, a lid, normally held open by a chain, falls shut, closing the can and smothering the fire. A fusible link in the lid's chain melts when heated, breaking the chain and letting the lid fall.

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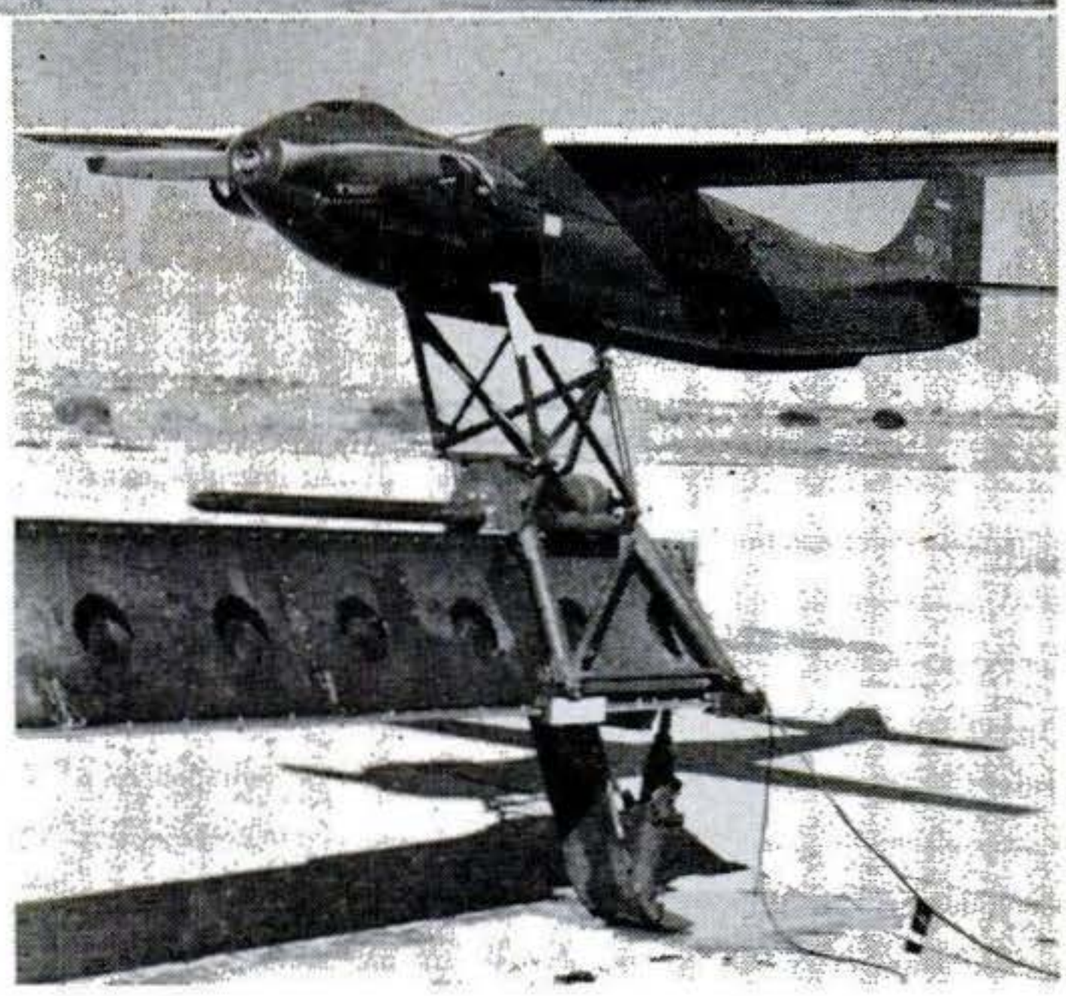
Rocket Launches Target Plane



THE Air Force's newest flying target, the OQ-19A, takes off from a rocket ramp at 80 m.p.h. The 300-pound plane, designed to simulate fighter tactics, has a speed of 220 m.p.h. and can be remotely controlled from either ground or air. It will be used for both antiaircraft and aerial gunnery practice. The craft is landed by means of a 32-foot cargo-type parachute that is released by the controller. In case of damage to the plane by direct hits, the 'chute opens automatically. The target plane is 10½ feet long, stands 2½ feet high, and has a wing span of 12 feet. It can climb 2,400 feet a minute to a service ceiling of 20,000 feet.

Twin Jets Power "Flying Lab"

SWEPTBACK wings distinguish the Air Force's latest research plane, the tiny Northrop X-4 shown above. It was not built for speeds in excess of sound, like the X-1 (PS, Aug. '48, p. 96), but is intended for exploring flight characteristics at high subsonic speeds. Since it is powered by gas turbines, the X-4 is capable of considerably longer flights than the rocket-powered X-1. One of the smallest man-carrying planes ever built, it is 20 ft. long and has a wing span of about 25 ft. The experimental plane has a tricycle landing gear and an ejection seat for the pilot.

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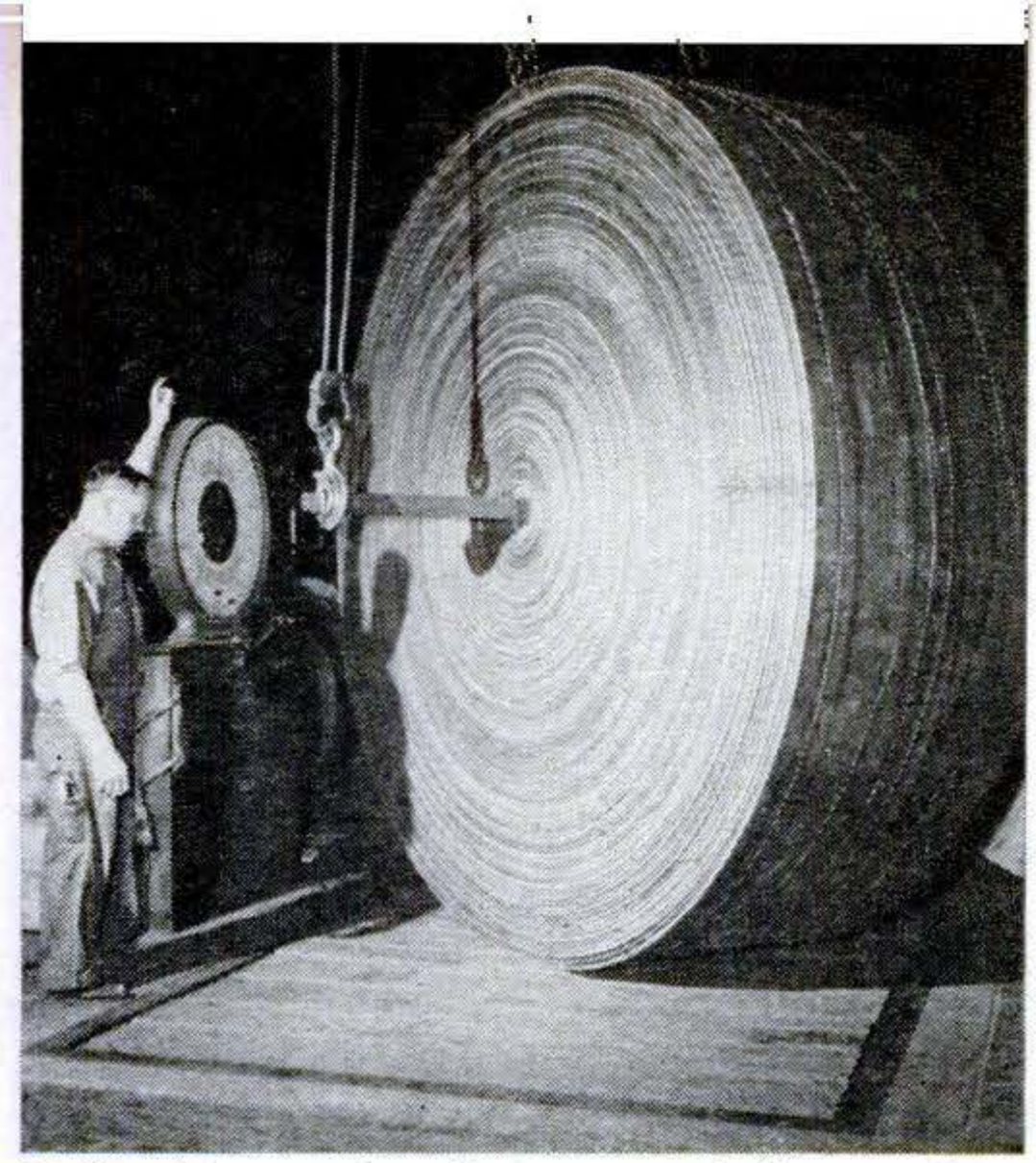
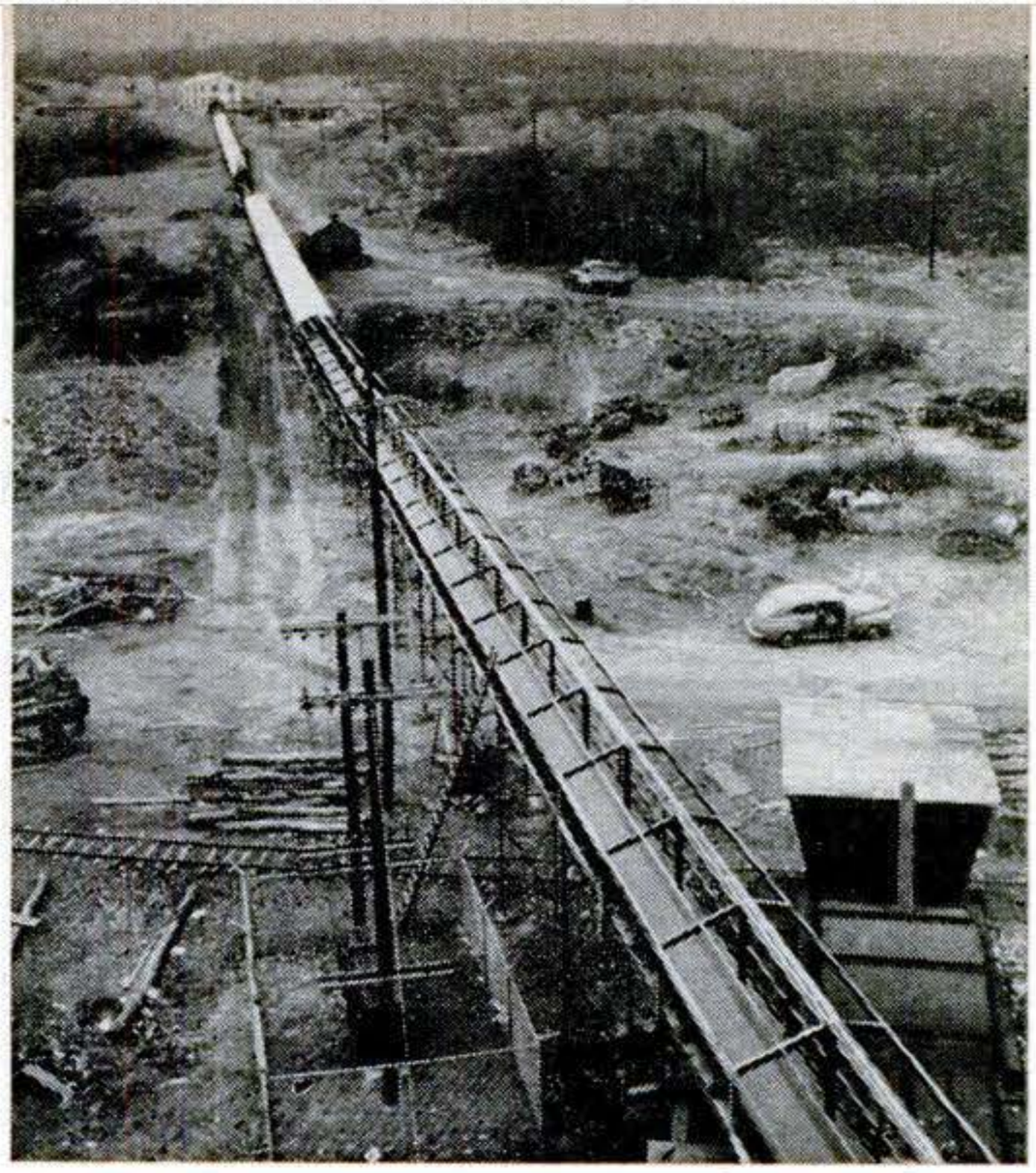
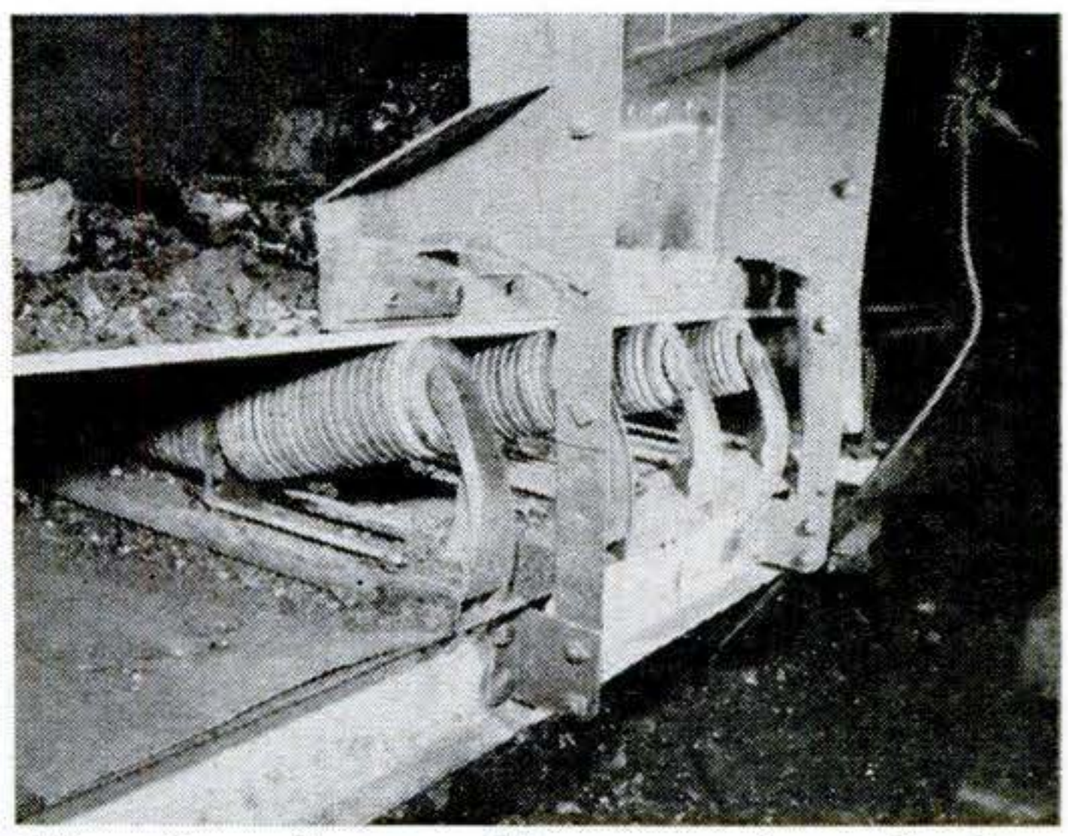


Roll of heavy-duty belt, 1,060 ft. long and 36 in. wide, tips scale at 6 tons before shipment from Passaic, N. J., factory. Five sections like this were spliced to make finished conveyer.



Overland conveyer spans rugged Pennsylvania countryside on trestlework (shown while still under construction). It carries coal from mine head, in distance, to railroad loading point.

Coal starts its long ride out of the mine as hopper pours it onto continuously moving belt at one of two underground loading points. This one is 700 feet vertically below the surface.



Side view shows rubber-covered steel idlers that cushion conveyer against shock at loading points. Belt is described as 250 to 400 percent stronger than others of similar construction.

Coal Rides Mile-Long Belt

A CONVEYER belt more than a mile long is now rolling 300 tons of hard coal an hour out of a Pennsylvania mine that had been shut down since 1931 because of the high cost of hauling its output to the surface in mine cars.

At the mine head, this conveyer dumps its load onto another belt that carries the coal 1,300 feet overland to a railroad loading point. Together, the two belts cut the distance the coal must travel by more than half—and the colliery's cost of producing a ton of coal by about 50 cents.

The underground belt, driven by a 400-horsepower engine, is said to be the longest inclined coal conveyer in the world. From the deepest of two loading points, at the center of a spider web of mile-long mine tunnels, it travels 2,640 feet to the surface up a 15-degree slope.

Both belts are made of rubber impregnated with fabric woven of high-strength cotton and nylon fibers. They were produced and installed by the U. S. Rubber Co. for the Moffat Coal Co., which operates the Storrs Colliery near Scranton, Pa.

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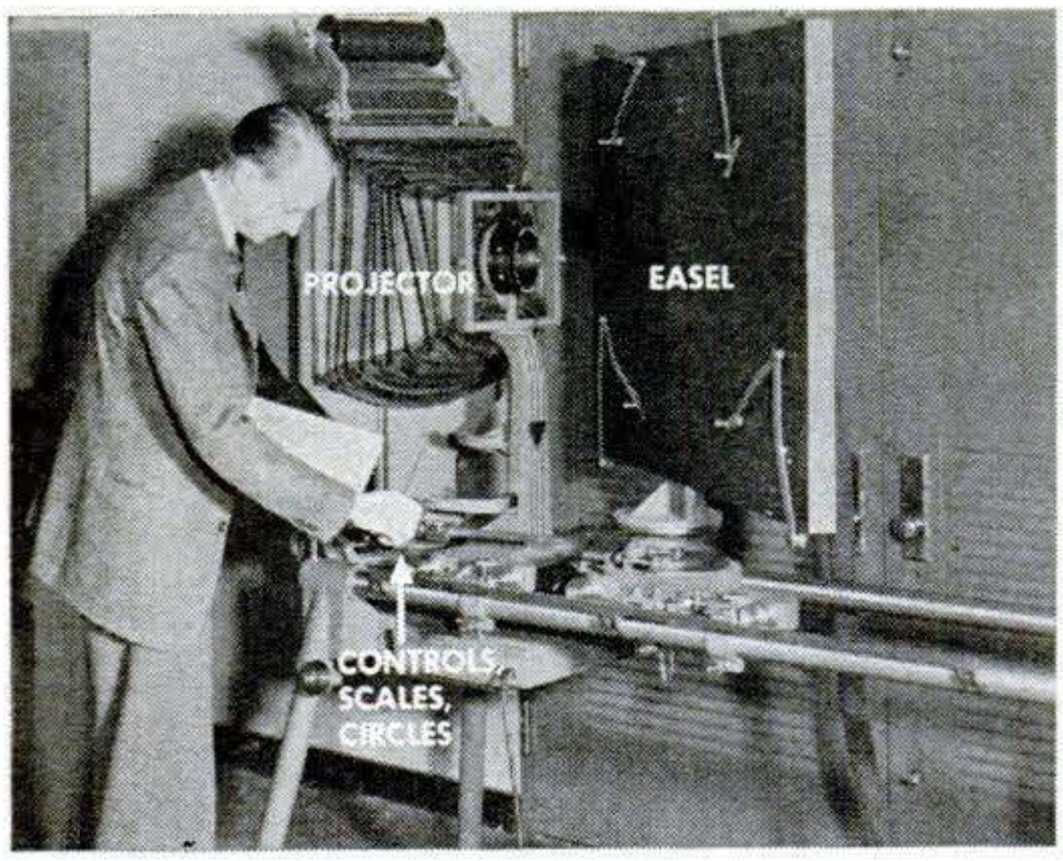
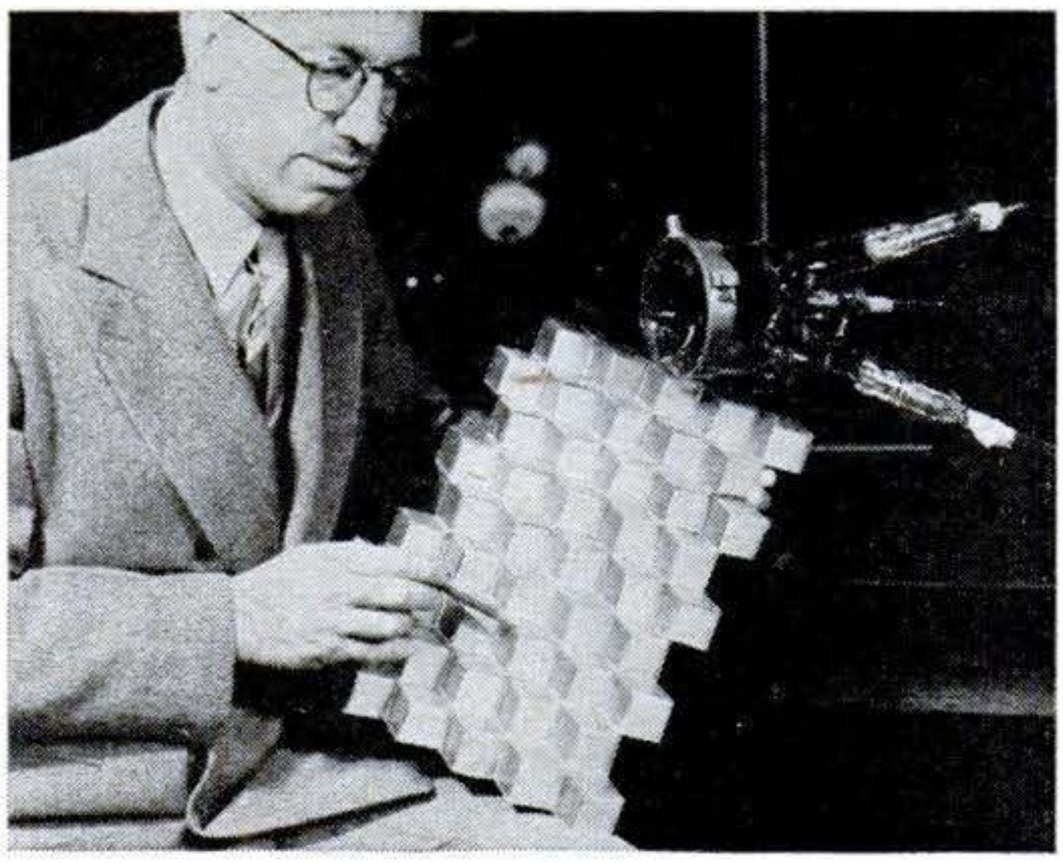
Magnet Analyzes X Rays. The eight-ton apparatus in the foreground above measures the distribution of energy in a beam of X rays from GE's 100,000,000-volt betatron. Electrically charged particles are produced from the rays and shot through a magnetic field. Their curvature in this field shows how much energy they have. Where each one hits is noted by a battery of 100 Geiger counters, whose reports are tabulated by a 300-tube electronic calculator. This saves physicists a lot of time.



Photoprinter Aids Mappers. This new projector and hinged easel extends the coverage of reconnaisance planes. Aerial photographers can now shoot undistorted pictures from angles other than straight down: high-angle shots are pulled back into shape simply by printing them at the same angle. The equipment, used by Army map makers at Ft. Belvoir, Va., is light enough to cart around in a truck.



Tube Shows TV in Color. Dr. Willard Geer, U.S.C. physicist, displays a greatly enlarged model of the back of his full-color television screen. Each side of the three-sided pyramids is coated to glow with one of the primary colors. For each color a separate electron gun, built into the three-pronged tube at right, is aimed to sweep only one side of the pyramids. The resulting spots of color blend into a single image.

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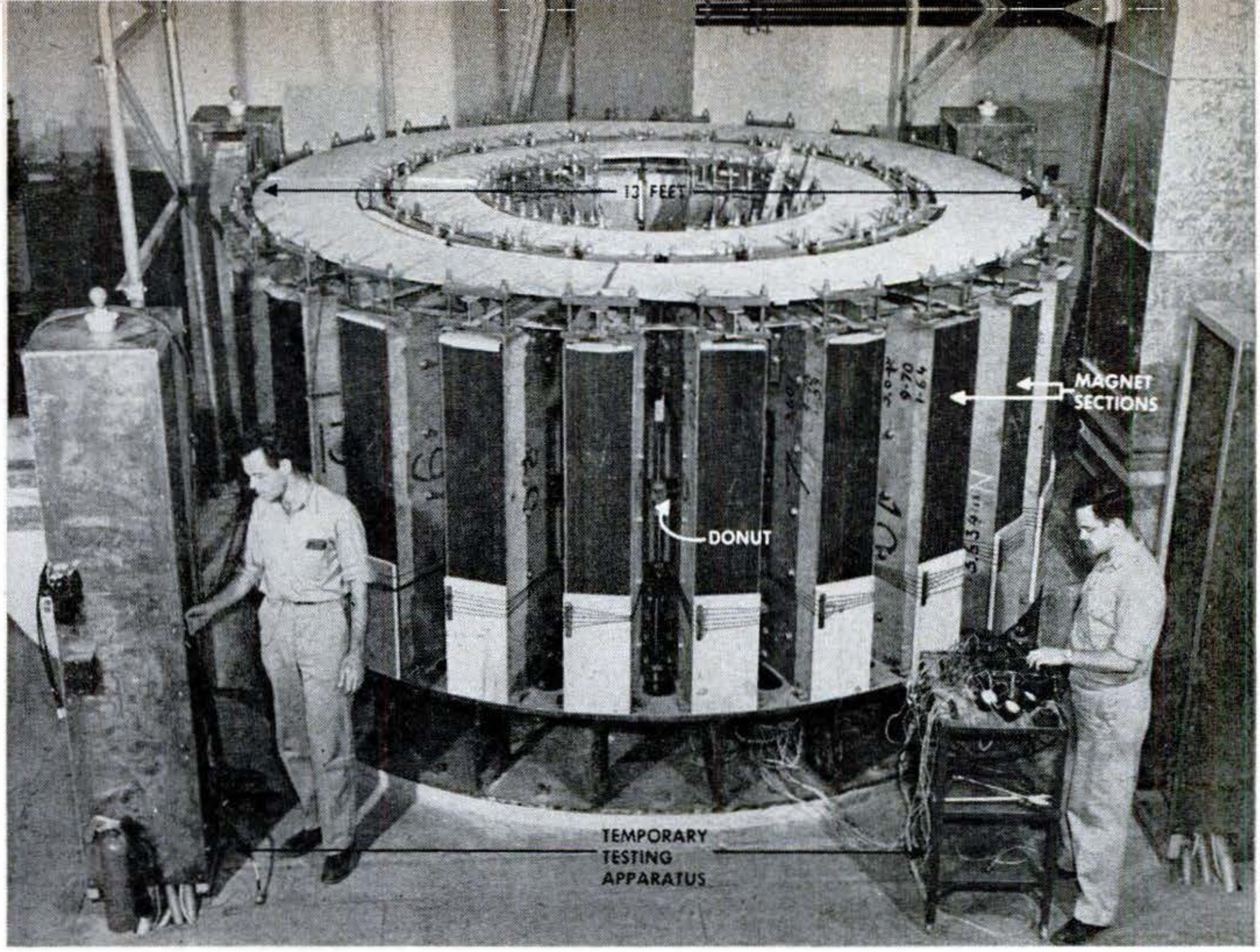
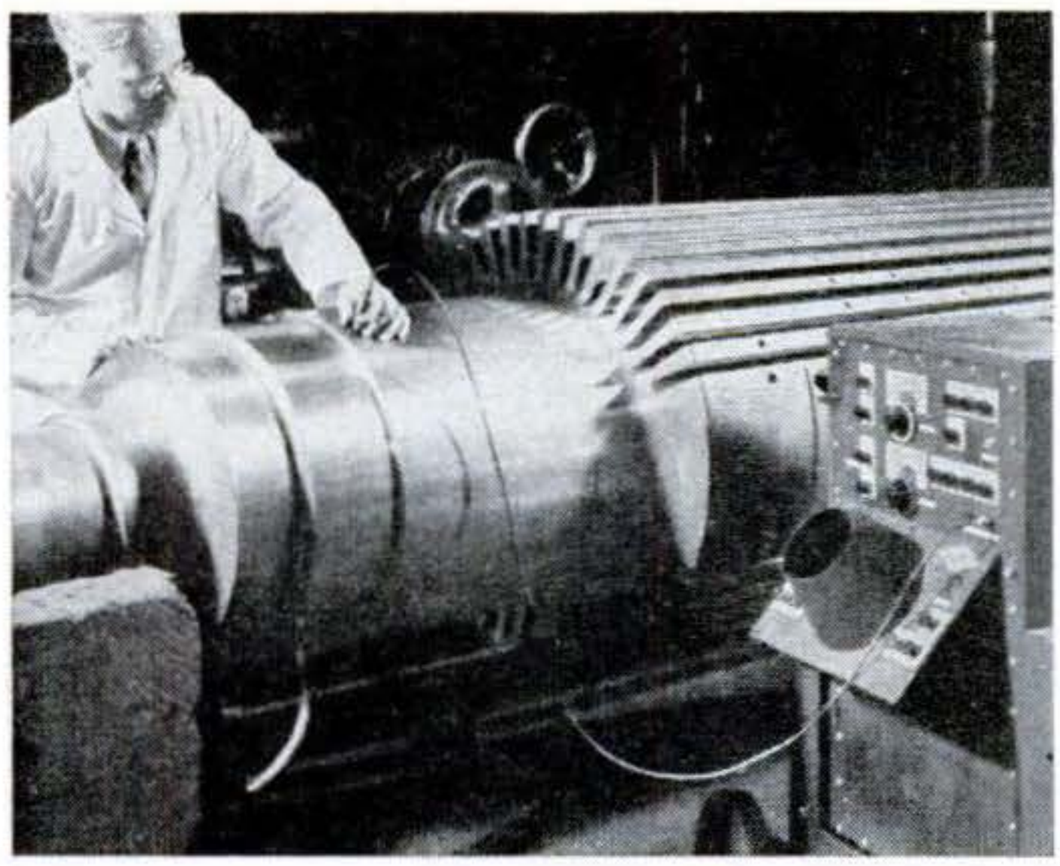
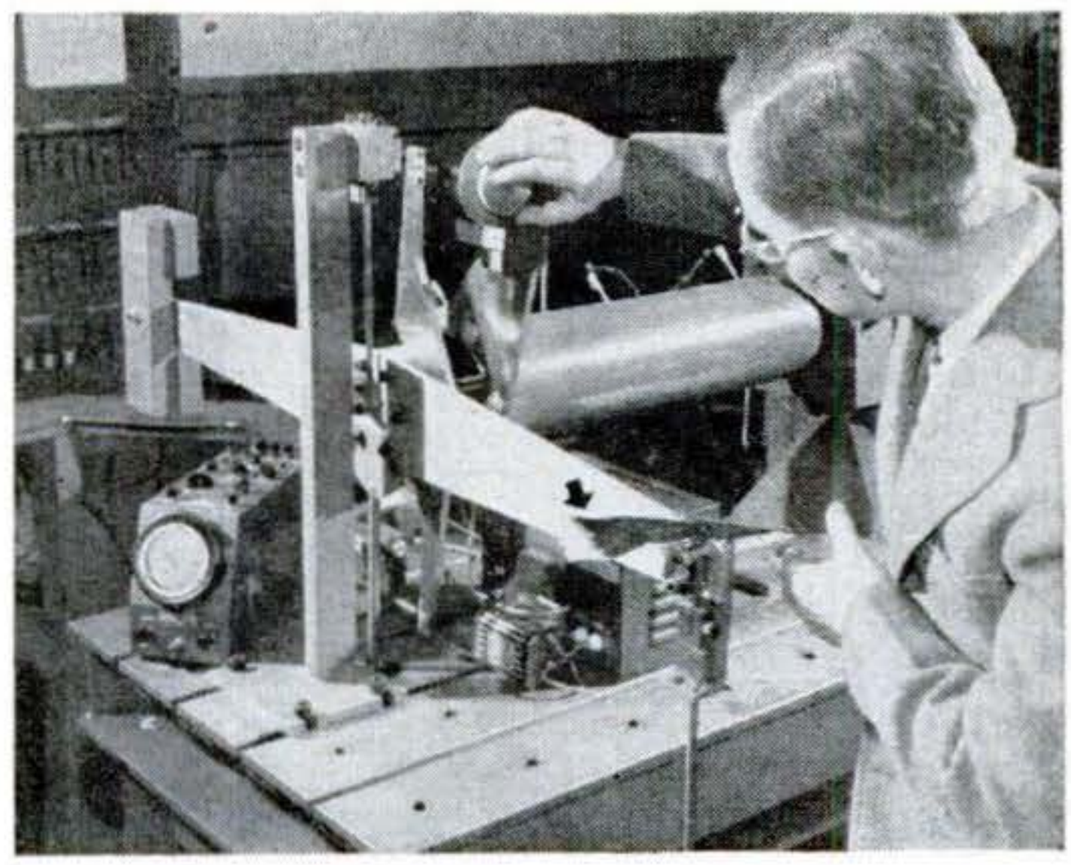


Atom Buster Is Born. This 85-ton synchrotron, shown nearing completion, is part of a new $2,000,000 Laboratory of Nuclear Studies at Cornell University, Ithaca, N. Y. Generators, switchboard, and condensers are in separate rooms. In operation, the synchrotron will hum like a big transformer as its ring of magnets pulls electrons around a glass-tube race track, called the donut, at an energy of 300,000,000 electron volts. New theories about electricity may result from experiments with the apparatus.



Stethoscope Tests Metal. This massive generator shaft, too thick to X-ray, is getting a physical checkup with a Westinghouse ultrasonic "stethoscope." High-frequency sound waves, projected through solid steel up to 30 feet thick, bounce back from the other side—or when they hit an internal flaw. Precise timing of the echo, recorded as a bright line on the viewing screen at right, locates any defect.



Feather Twists Steel Shaft. The electrical-contact fingertips of this twist detector are so sensitive they can measure the movement caused by placing a feather (arrow) on a crossarm bolted to a 1-in. steel shaft. (Answer: the shaft, inside the cylinder extending to the right, twists less than 1/1,000,000 in.) Westinghouse uses the device in designing instruments to measure the power delivered by rotating machinery.

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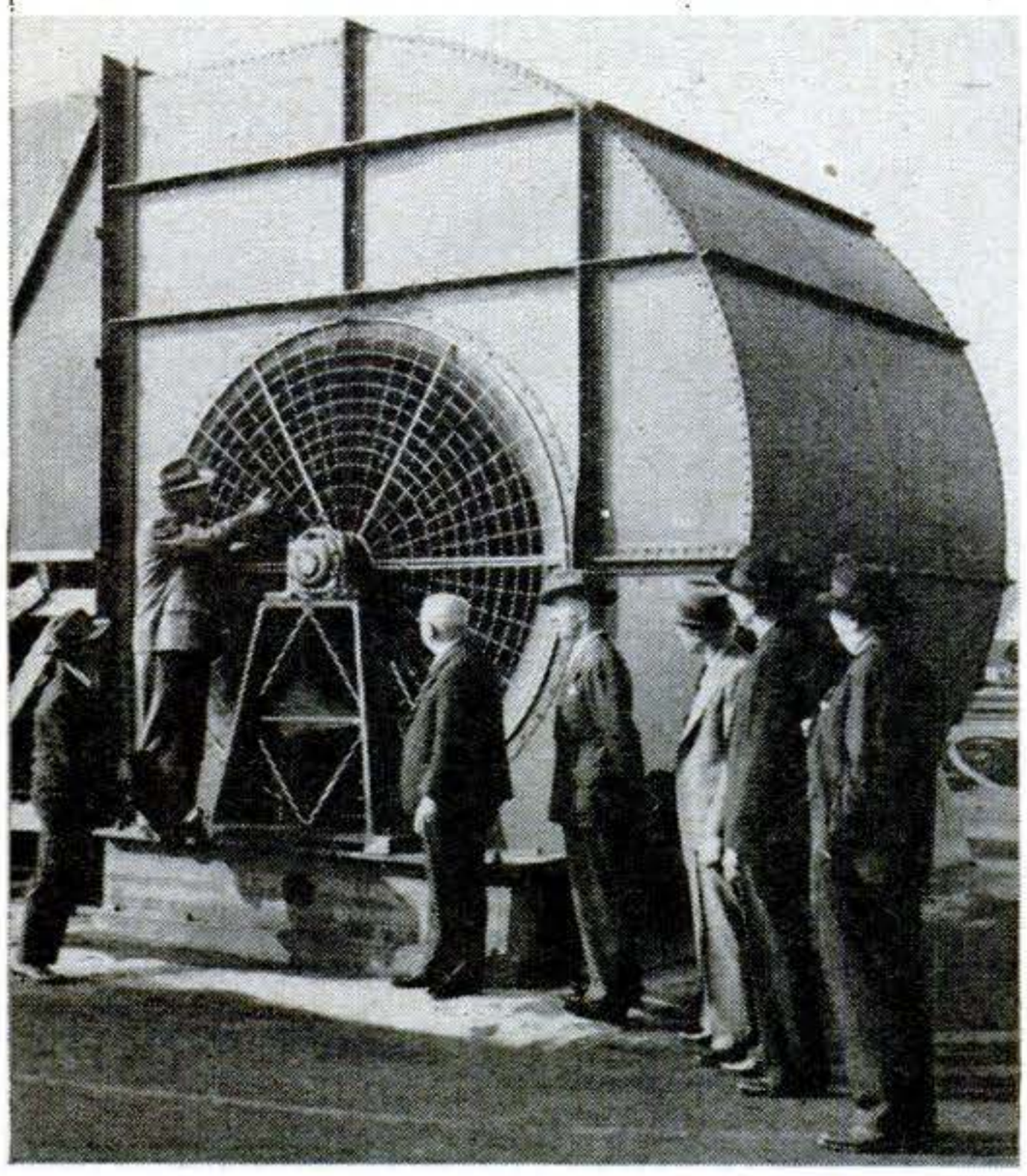
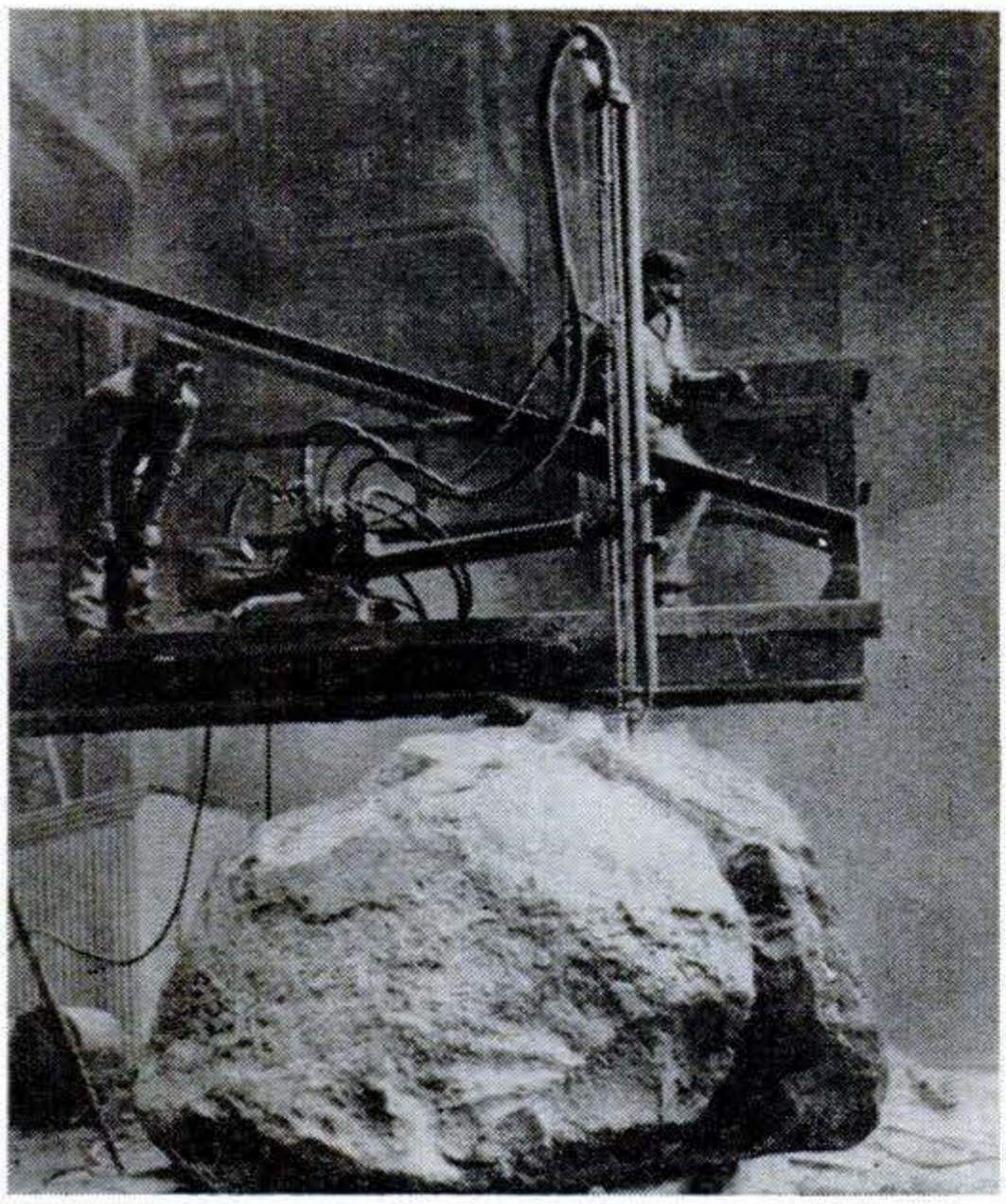
Alcohol Made from Gasoline

SYNTHETIC alcohol for use in the manufacture of plastics is made under a pressure of 3,000 lb. per sq. in. in this Esso plant at Baton Rouge. Gasoline, hydrogen, and carbon monoxide react in the presence of a catalyst to form the iso-octyl alcohol.



Blower Breathes for Tunnel

THIS giant, 15-foot-high Westinghouse fan will blow 281,000 cu. ft. of fresh air a minute into New York's Brooklyn-Battery Tunnel. It is one of 53 fans that will feed the tunnel 25,000 tons of air an hour.



World's Biggest Blowpipe

THIS big blowpipe, largest in the world, can cut through 6-foot-thick chunks of steel that formerly had to be blasted apart. Made by Linde Air Products, the mixer-type pipe burns acetylene under medium pressure.

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"Can you get this spot out?" "Yes, Mr. Loosbrock—if you can tell what you spilled on it."

What the Cleaner Does to Your Suit

By John F. Loosbrock

REMEMBER that suit that came back from the dry cleaner with the spot that wasn't there when you sent it? Made you mad, didn't it? And the cleaner said, "Leave it with us a week or so, and we'll either get it out or find out why it won't come out."

Chances are your spotted suit then became one of the thousand-odd problem garments that every month roll into the "chamber of horrors" of the National Institute of Cleaning and Dyeing at Silver Spring, Md., near Washington, D. C. More

Suit starts through model plant operated by National Institute of Cleaning and Dyeing at Silver Spring, Md. Marker attaches identification tags of soft cloth with large safety pins.

than 7,000 institute members, in the U. S. and 27 foreign countries, use its free analysis service to untangle their knottier cleaning problems. And its word is usually taken as gospel by small-claims courts and Better Business Bureaus throughout the nation.

If the Institute experts looked over your stained suit, they put it under an ultraviolet light. The spot then may have showed up as a light-yellow stain. That would have meant it was tannin, arch villain of the dry-cleaning business.

It also would have meant that the stain probably was there to stay, since the suit had already been pressed. Heat will set a tannin stain until nothing can get it out except a pair of scissors. And it's probably the most common of all stains—caused by soft drinks, beer, ale, highballs, tea, or coffee. If only you had told your cleaner what you spilled on the suit, he could have removed the stain before pressing.

Besides its analysis service for members, the Institute runs a model commercial cleaning shop to set standards for this billion-dollar-a-year industry. The pictures on these pages show how its experts gave one of my suits the works as a demonstration for POPULAR SCIENCE readers.

Detectives Identify Holes

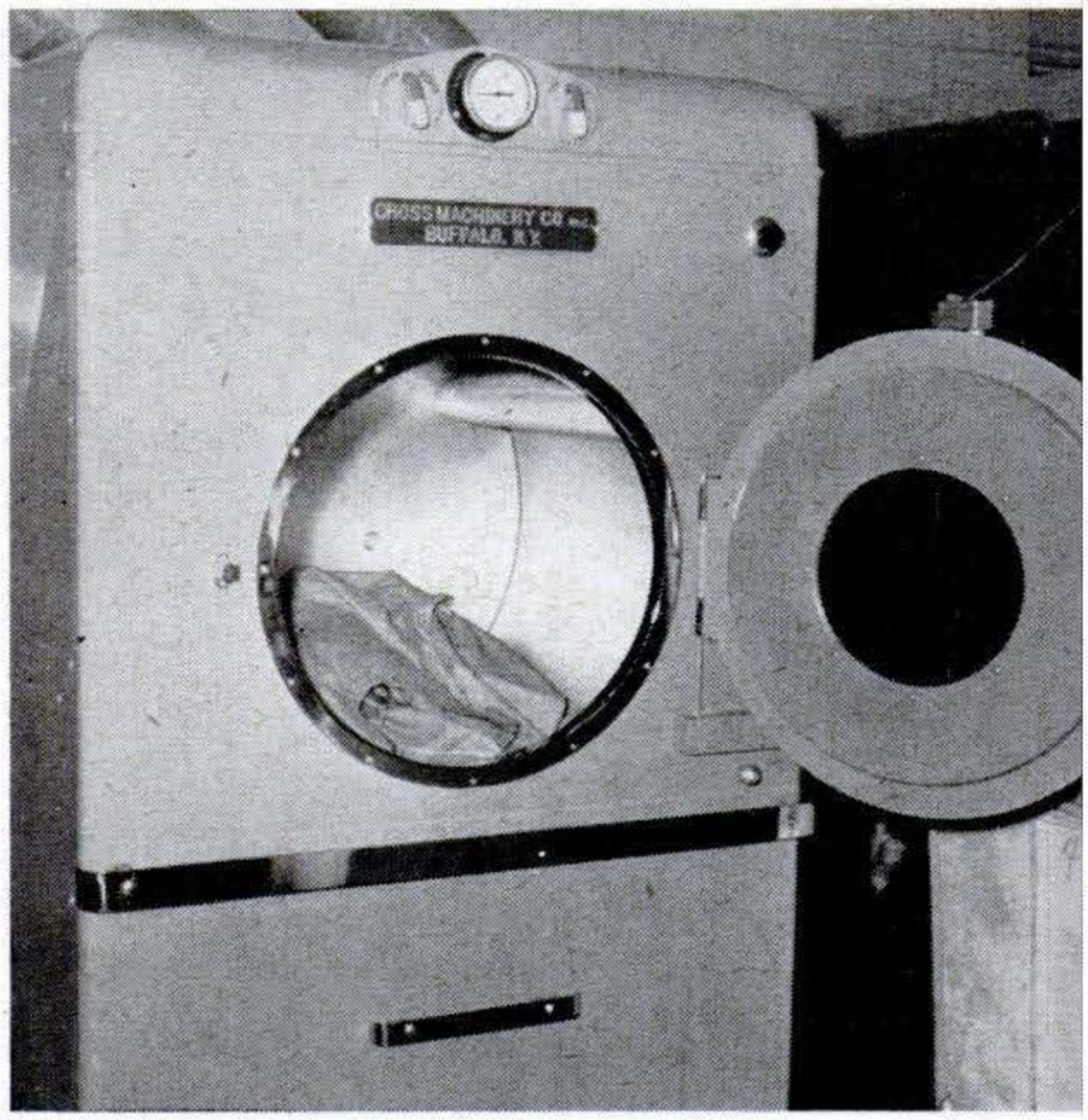
A common customer complaint, says the Institute's analysis department, is the discovery of a hole that shows up for the first time after cleaning. Perhaps the customer had brushed up against some battery acid. The spot wasn't noticed, the suit went to the cleaner's, the heat of finishing evaporated the water out of the weak acid solution. Result: a hole where none was before, an irate customer, and a red-faced cleaner.

The Institute puts a hole like that under the ultraviolet lamp. If it's an ordinary tear, it looks about the same as in daylight. But if it's chemical damage, a light ring appears around the hole, showing further damage not visible to the naked eye. And if the cleaner wasn't told about the damage when he received the suit, he's usually absolved.

Or a suit may fade and the cleaner be blamed. The Institute experts examine the underside of the lapels and the inside of the cuffs. If the color in those places is clear and fresh, they conclude that the sun caused the fading. If it were the cleaner, the suit would have faded all over.

They may also snip a swatch of material from an inside seam and put it in the fadom-

Revolving brushes whisk lint from trouser cuffs before a suit is cleaned. Pockets are turned inside out. A "pre-spotter" removes any stains that might be set by the cleaning process.



To complete drying, suit is put into this tumbler. As drum revolves, a current of warm air carries off remaining solvent. Speed and heat can be varied for different types of garments.

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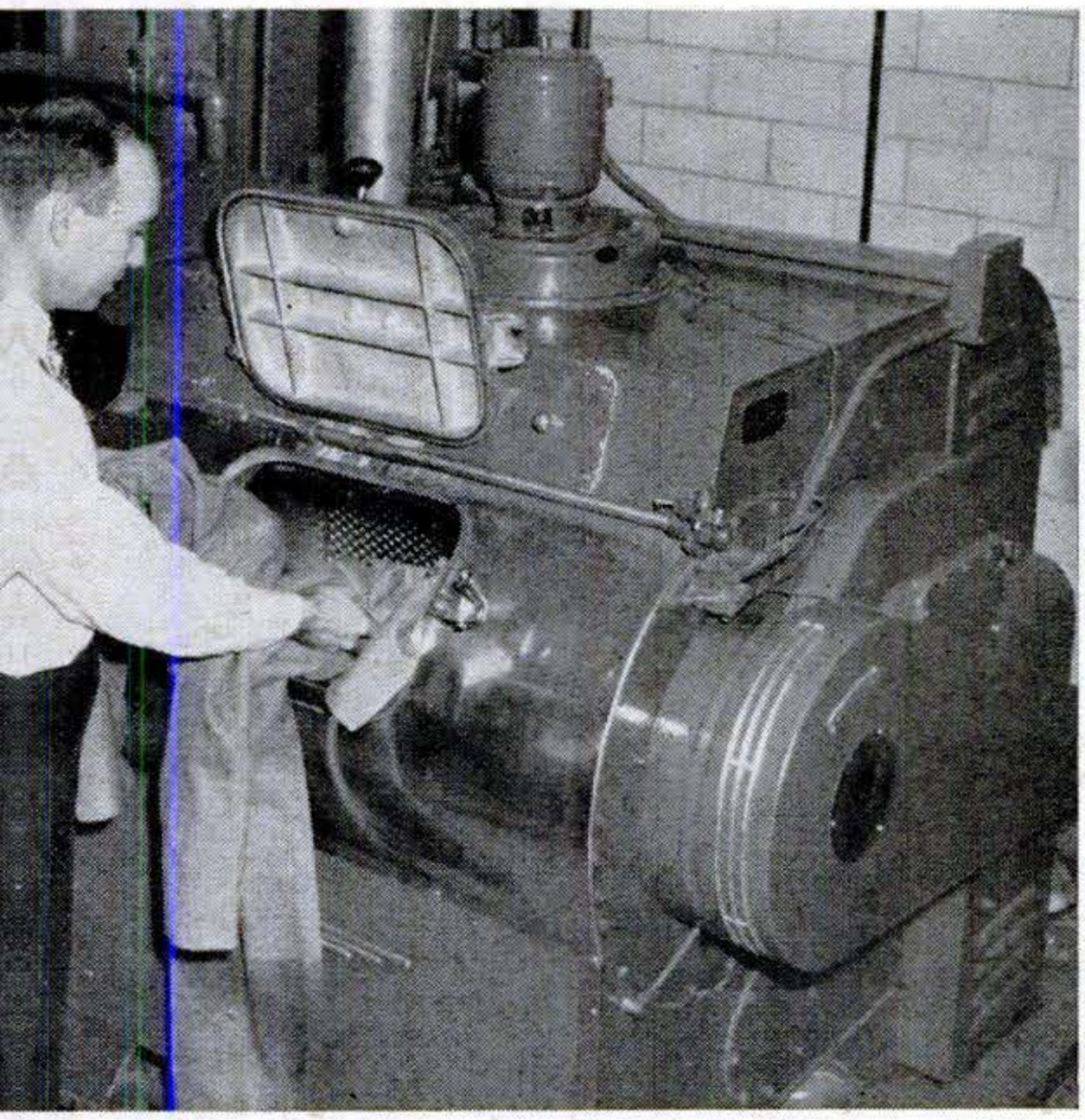
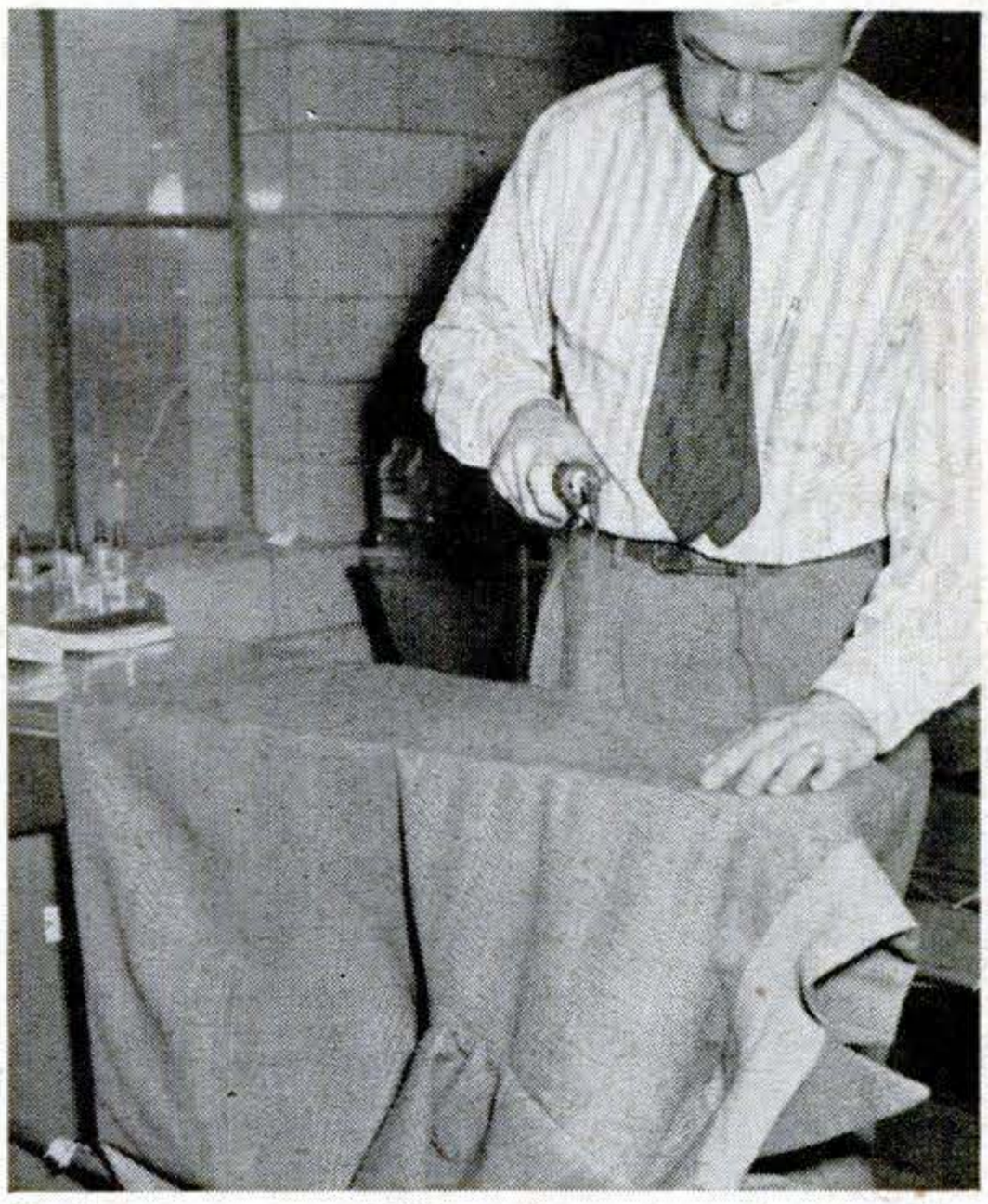
Dry-cleaning machine (center) works like a rotary-drum home washer. It uses petroleum-base solvent instead of water and synthetic detergents instead of soap. At left is filter through which solvent is continuously circulated, at 3,000 gallons an hour, to strain out dirt. From washer, garments go into spin-drier (right) where most of solvent is whirled out.



Another type of washer both cleans and dries. It uses synthetic solvent that is noninflammable but gives off toxic fumes. These are caught inside sealed machine, condensed, and re-used.



Stains not removed by solvent are taken out by "spotter," the artist of dry cleaning. He uses steam jet and a battery of stain-removing agents. Toughest trick is to avoid leaving a ring.

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Coat is finished on form inflated with steam, then hot air, to restore shape. Lapels must roll perfectly, shoulders round neatly. Sleeves and lapels are then touched up by pressing.

Trousers are finished on steam presser. Screened head (upper plate) prevents shine. Other heads adapt it to smooth or rough fabric. Heat, pressure controls prevent shrinking, scorching.

eter, which simulates sunlight with a powerful carbon arc. If the sample fades, that clinches it. Claim dismissed.

But if the cleaner has been at fault, the Institute will say so. It plays no favorites. In fact, it likes to track down faulty cleaning practices. Doing so helps to raise the standards of the industry as a whole.

Another common gripe is the fading or changing color of acetate rayons containing blue dyes. Ever send a rayon sport shirt to the cleaner and have it come back a sickly pinkish purple? That wasn't the cleaner's fault. It probably was caused by atmospheric gases in your home—from a stove, furnace, or water heater. The heat of pressing merely hastened the process. The Institute can prove it in a minute by putting an unfaded swatch in a miniature gas chamber.

The increase in synthetic fabrics during and since the war has been a big headache for cleaners. Says the Institute's managing director, J. M. Matson: "Before the war, claims against dry cleaning plants ran about one-half of 1 percent of total sales. Now they're running about 1½ percent. People used to know pretty well what they were buying. Now they can't be sure. It's our job to find the answers before the cleaner gets hurt."

That's one of the reasons the Institute's research and analysis departments are moving into a new million-dollar building.

As an example of the Institute's work, research director George P. Fulton points with pride to his campaign against buttons and ornaments of polystyrene plastic. A clear plastic, cheaper than glass, it has a disconcerting habit of disappearing completely in cleaning solvent. The Institute worked closely with manufacturers—and now the polystyrene button has pretty well disappeared from the market too.

Top item of current research is the evolution of a standard soil swatch of cloth for tests. Then the Institute can set more definite standards for soaps and solvents.

Its experts are also looking into why wool shrinks. They like the idea of chemically preshrunk wools. And they don't think these will drive the dry cleaner out of business. Even though wools may eventually be washed like cottons, they'll still need careful finishing. END

Manpower Surpasses Horsepower

AN ATHLETE may achieve an output of energy as high as 10 to 13 horsepower in a 100-yard sprint, a British physiologist reports.

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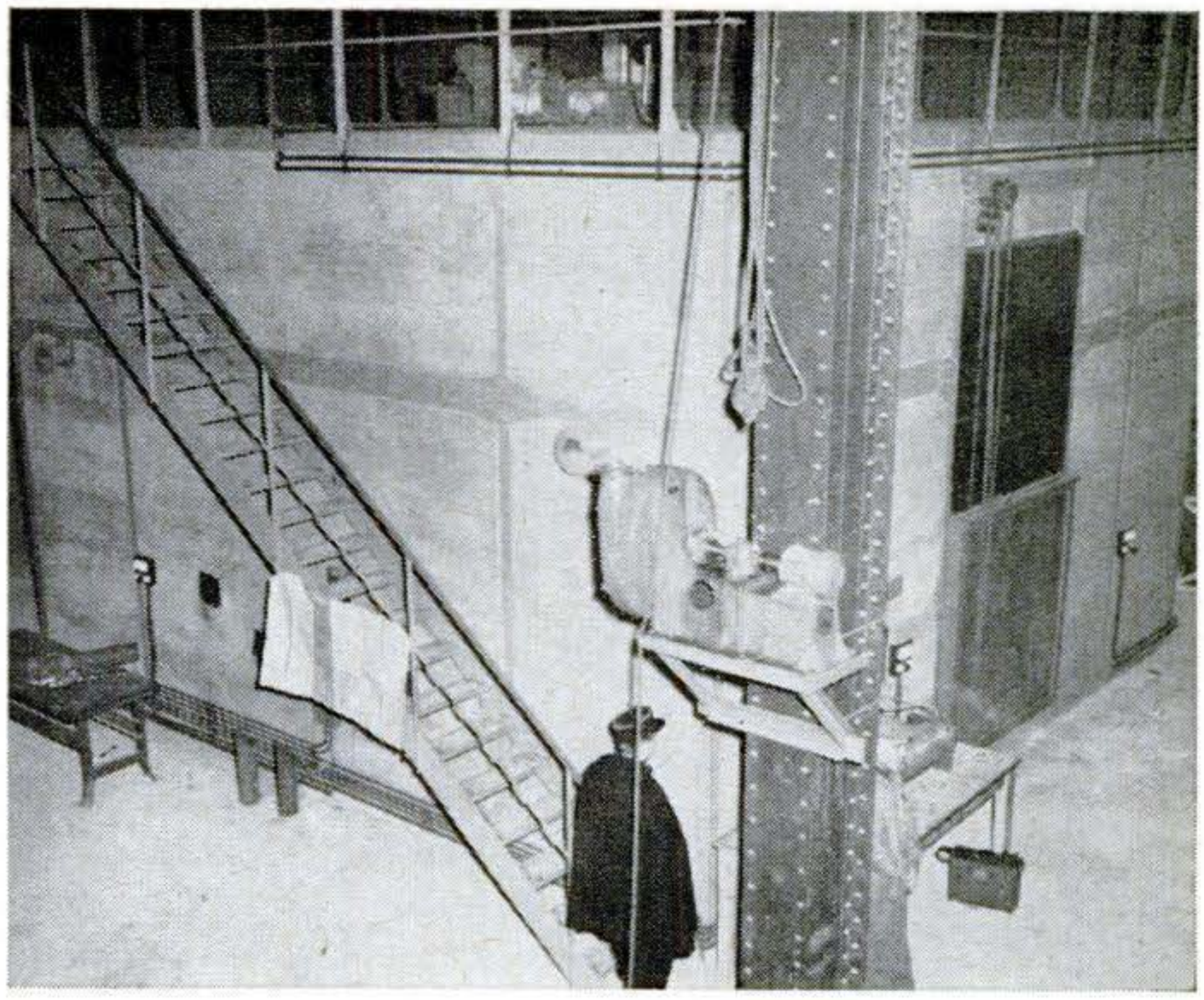
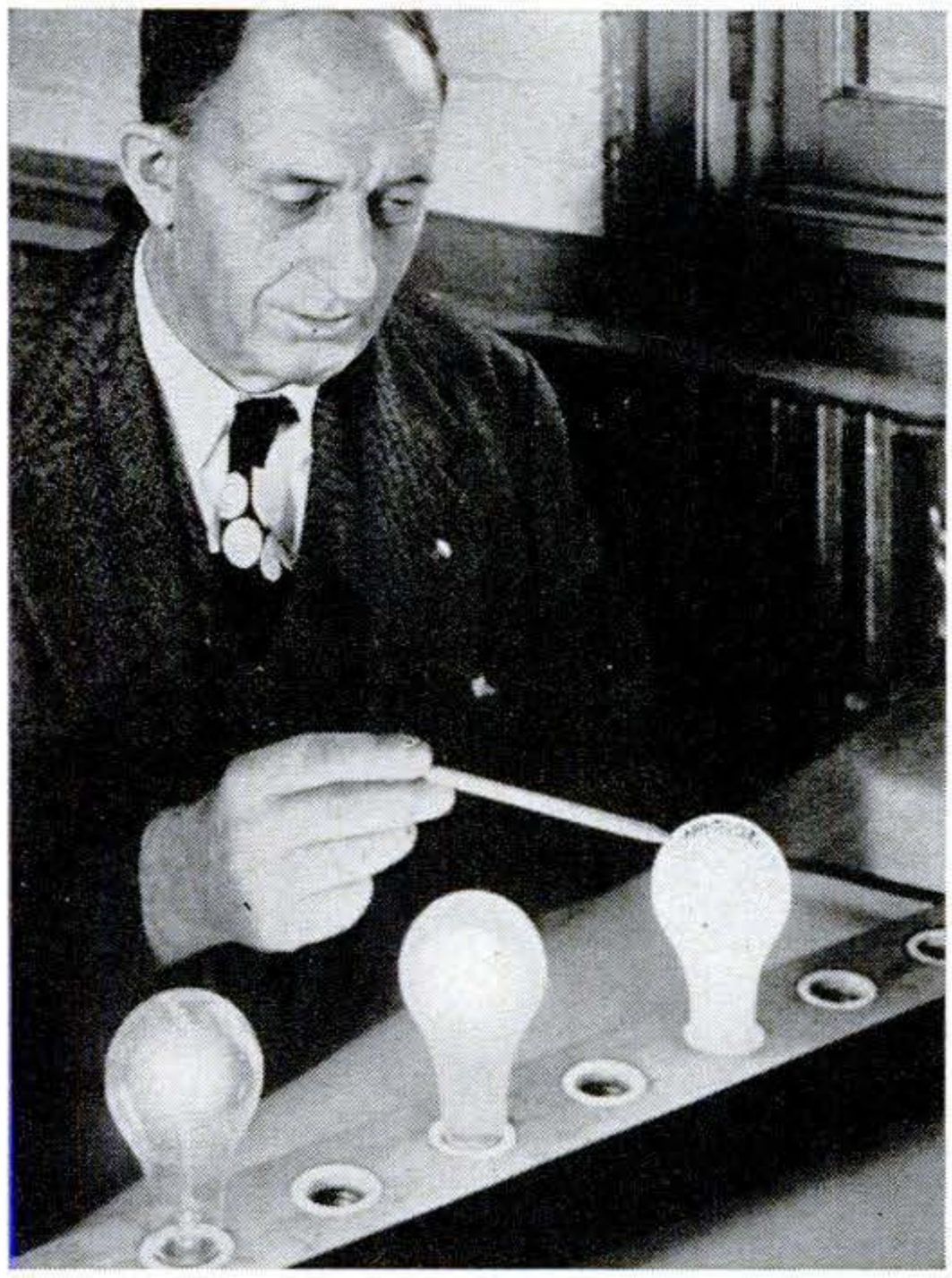
France Starts An Atomic Pile

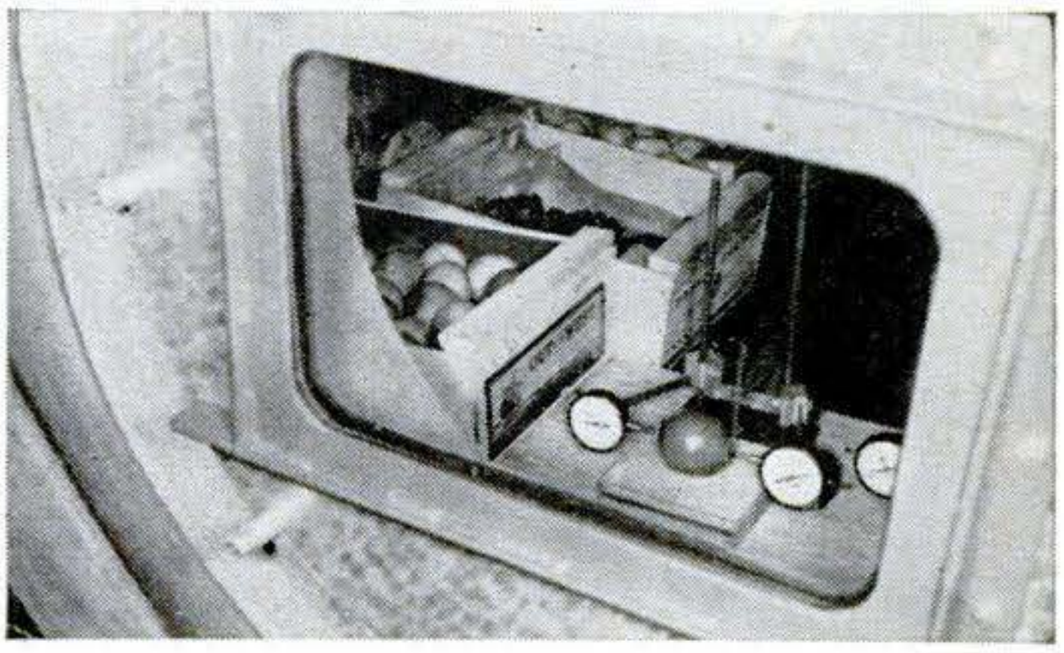
THE concrete room at right contains the first atomic pile known to be operating outside the U. S., Britain, and Canada. Run by the French Government at Fort de Chatillon, near Paris, it recently began producing neutrons by chain reaction of uranium. Unlike most U. S. piles, it uses heavy water instead of graphite as its second essential element. Intended only for research, the small French pile generates little power and no significant amount of materials for bombs.





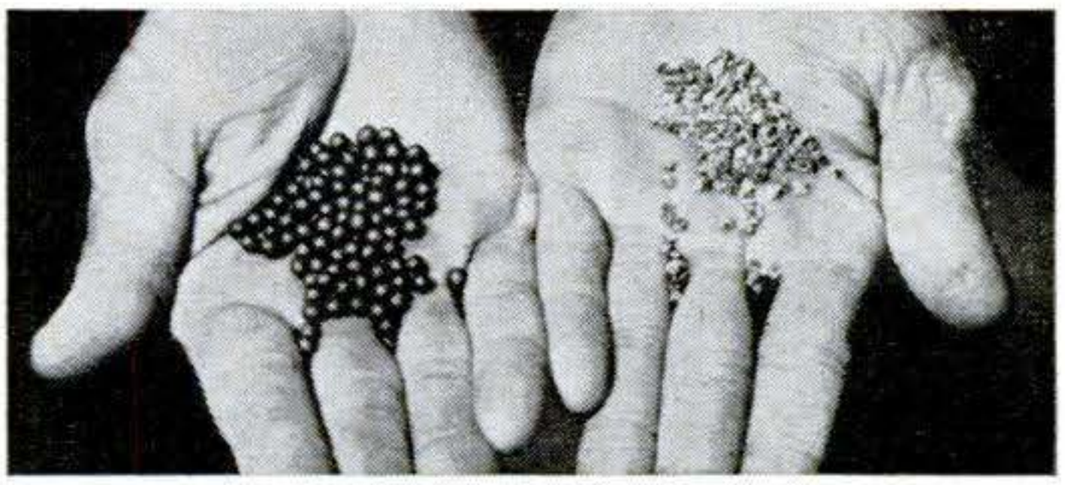
New Bulb Glows All Over

THE man who invented the frosted light bulb, back in 1925, has now developed one that scatters its rays even better. He is Marvin Pipkin, of GE, shown pointing to the improved lamp as it glows—right down to its base—alongside its predecessor and a clear-glass bulb at left. The inside of the new lamp is coated with a white silica substance that diffuses light almost perfectly without cutting down its brightness.



Fruit Passes Flight Test

WILL fruits and vegetables burst if shipped in high-flying planes? To find out, the Dept. of Agriculture "flew" 34 kinds—including this tomato, flanked by micrometers—in Lockheed's altitude chamber. All stood low pressures equivalent to 30,000 ft.



Pellets Save Seeds, Aid Growth

TINY garden seeds often are wasted by being sown too thick. Now Henry A. Dreer, of Philadelphia, puts them in pellets that not only add bulk and weight but include fertilizer, vitamins, hormones, insecticide. Above: coated and plain sugar-beet seeds.

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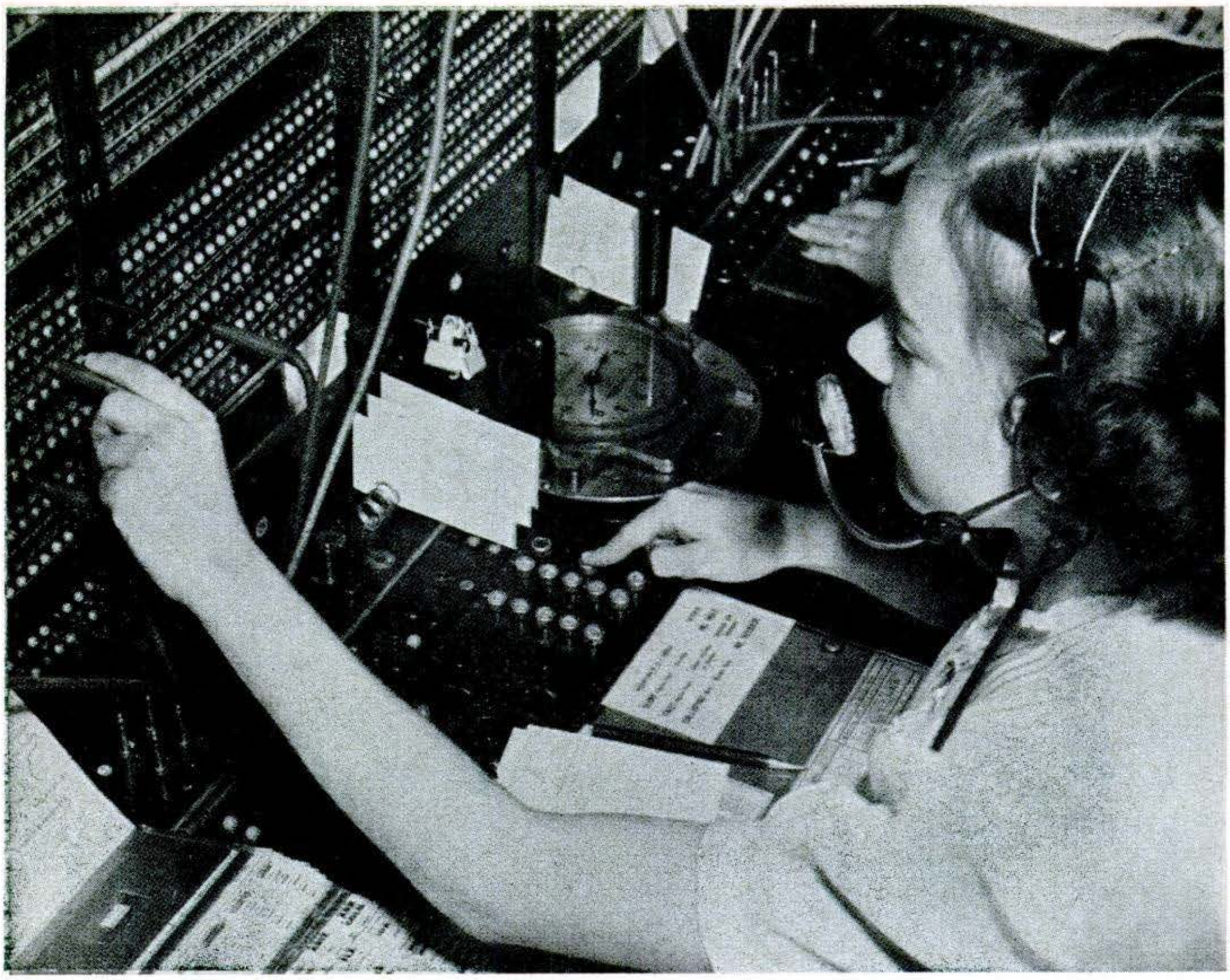

This operator in New York can ring telephones in 70 cities—from Lowell, Mass., to Chicago—just by pressing the keys near her right hand. Ten keys correspond to finger holes in ordinary dial, three control the complex switching mechanism. Card index at left tells operator how to route calls and gives codes that must be punched to reach certain areas of country.

This Maze Saves 1 Minute

New toll-dialing equipment cuts time for long-distance connections in half.

YOU can call any place in the country in about two minutes now. But soon it will take only one minute.

The Bell System's new toll-dialing equipment, which enables an operator to connect your phone directly to telephones hundreds of miles away, is expected to cut the time needed for long-distance calls in half. The saving comes from eliminating the work of a second operator at the other end.

Already serving 300 cities, the new equipment is rapidly being installed all over the country. It will be years, however, before it covers all the United States and Canada.

It takes a mass of fantastically complex apparatus to save you that minute. The recently completed installation in New York alone cost $13,000,000 and occupies space on six floors of a big building. A crew of 400 technicians spent a year setting it up.

To talk to your aunt in Chicago from your home in New York, you now simply give the number to the New York operator. She punches the number (plus in some cases a geographical code) on ten buttons. And your aunt's phone rings.

Toll-dialing is only part of still more complicated—but easier to use—systems to come. Ultimately, Bell plans direct connection between any two telephones anywhere in the country. That requires another huge mass of equipment to keep tabs on your calls so that the company knows how much to bill you (PS, Feb. '49, p. 135).

Phone-to-phone dialing will then not only save time but lengthen the odds against your getting a wrong number.

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This is only a part of the maze of wiring, switches, and other apparatus needed to enable an operator to dial long-distance as shown on opposite page. The mammoth New York installation has 2,000 circuits to permit connection to about 70 distant points. There are 522 "frames" of the crossbar switches that make the actual connections, 655 "bays" of relay racks, 89 tons of batteries, and—in case of power failure—four motor-generator sets. Much of this equipment must be called into action to complete one call, which requires 100,000 electrical contacts.

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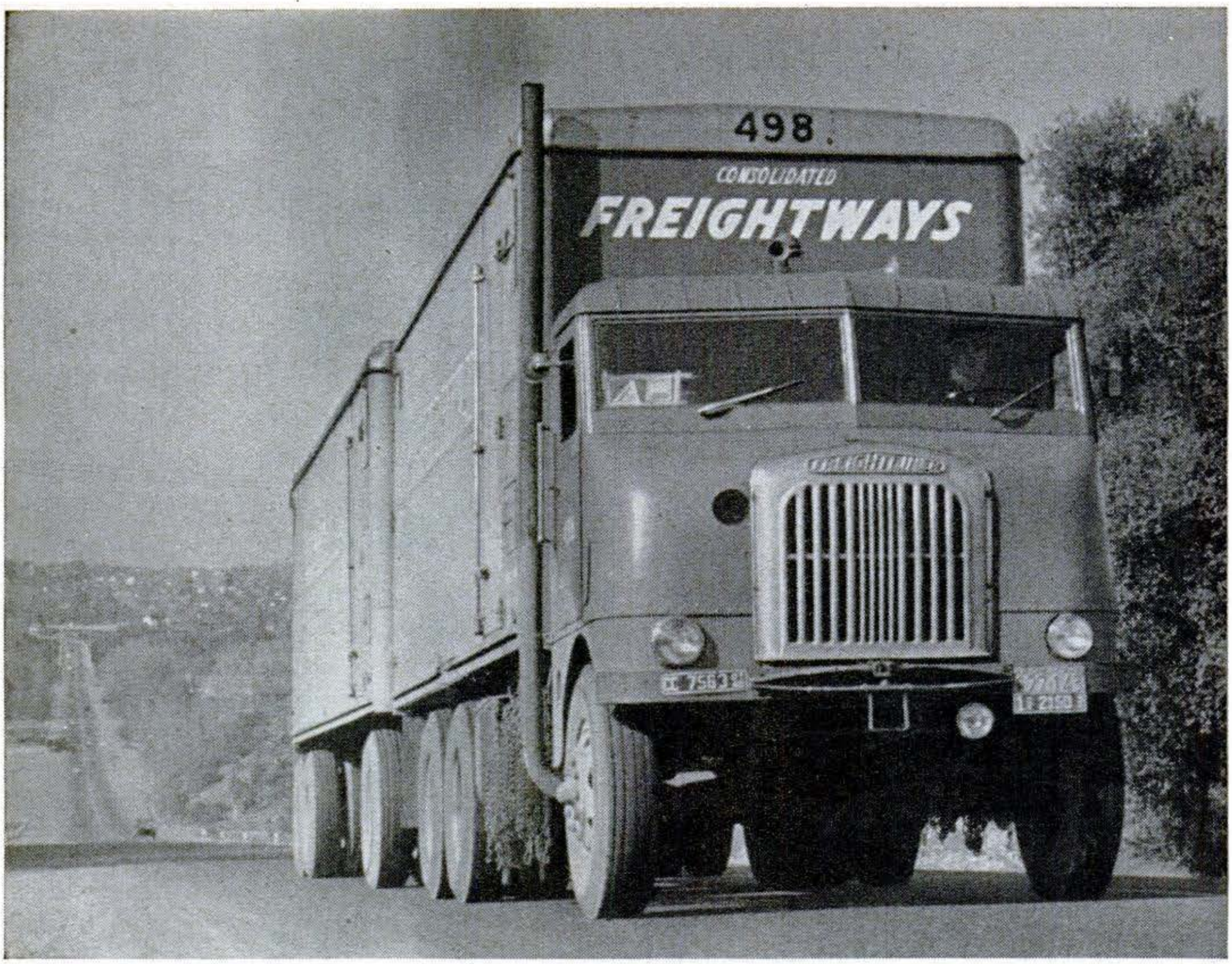

This huge Diesel truck-trailer combination is typical of motor-express trains that haul 68 percent of all freight in western states. Drivers halt only for fuel, servicing, and meals.

Highballing the Highway Freighters

Photographed at truck stations of Standard Oil Company of California by Jon Brenneis

As a specialized machine, today's great highway motor freighter has become as complicated as a railroad locomotive.

Big rigs, with two gear shifts, have as many as 32 speeds. Shifting these behemoths, while steering with one arm through the wheel and both hands on the gear levers, is no job for a boy.

Gears, not motor acceleration, regulate speed. On downhill grades a close watch must be kept on the tachometer if the powerful engine is not to tear itself to pieces.

Big trucks travel at 40 to 50 m.p.h. on the straight, level stretches. Some of the newer Diesels, however, can hit 90. Engines of up to 300 horsepower permit a good driver to stay in higher gears on grades and maintain a faster schedule.

Drivers are as conscious of the wind as an airplane pilot. A headwind that would go almost unnoticed by a motorist can force the driver of a big van to go down two notches in his gears to maintain headway.

In 11 western states, 15,000 communities depend entirely on motor express. But the truck-trailer combinations are now a part of the American scene in every state. Indeed, some trucks have become wheeled versions of the tramp steamer, swapping loads as they roam the country. Recently one furniture-van driver was nine months out from his home port, had visited 16 states—and was still going strong!

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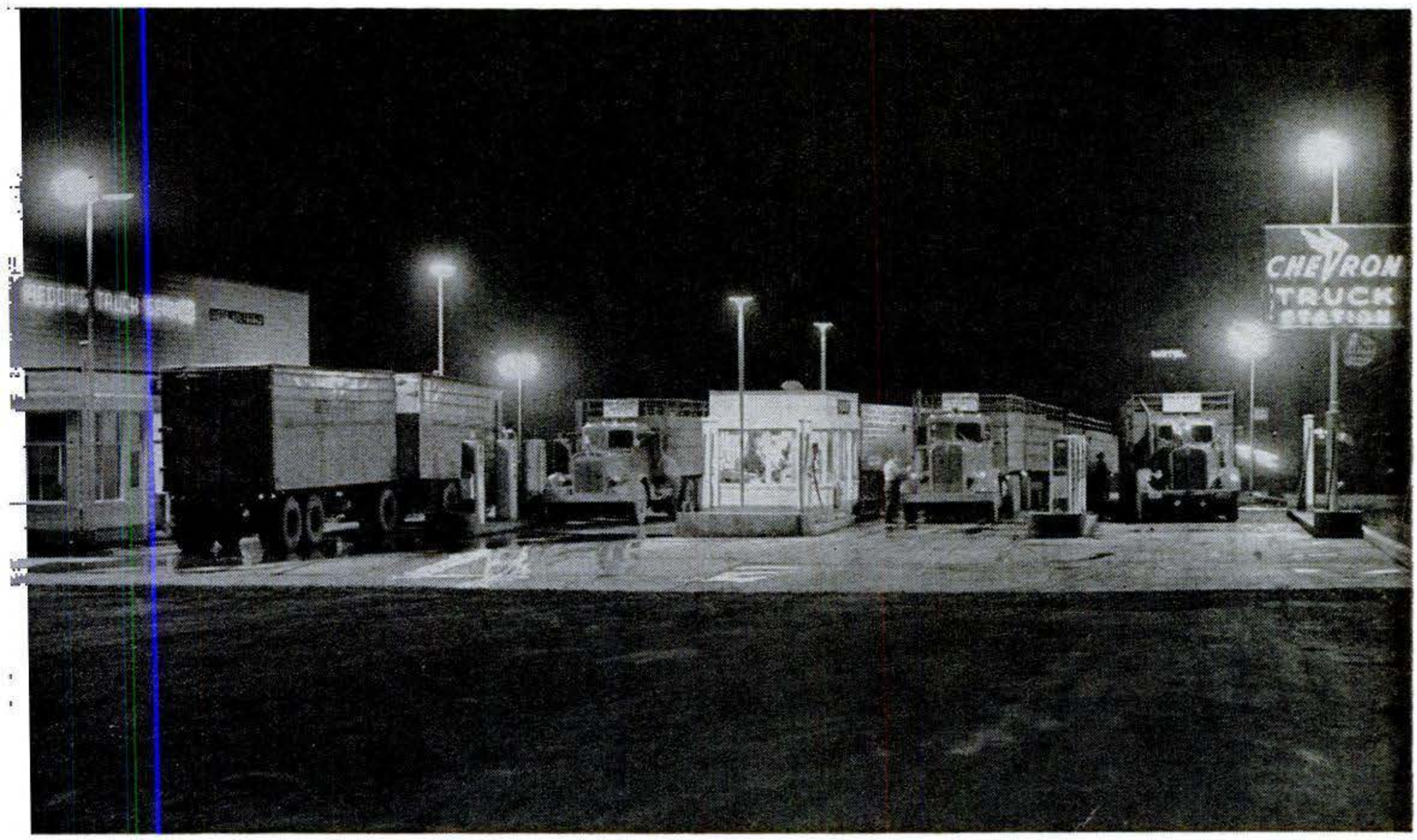
Two drivers highball highway freighter day and night. On single trip, it may run through rain, mountain snowdrifts, desert sandstorm. Runs of 1,000 miles in 36 hours aren't unusual. While one man drives eight hours, other sleeps on box springs and mattress in separate room behind cab. Some veterans say they sleep better on the road than at home. Like sailors, truckers keep their narrow quarters neat and clean. Checkups by inspectors of Interstate Commerce Commission encourage this tradition.

Pet peeve of long-haul trucker is mechanical "squealer" (right), staring at him from top of dashboard. This gimmick keeps record for home office of freighter's mileage, speed, time on road, length of stops. A more serious problem is lack of uniformity in state laws limiting trucks' weight, length, height, load. About 60 feet is maximum length. Restrictions in Midwest bar biggest "combos" from coast-to-coast runs. California, one of the most liberal states, allows a gross weight of 75,200 pounds.



Outsize gas stations, with extra-wide lanes, fuel and service the highway trains. This one at Redding, Calif., takes care of four at once. Fuel and air hoses unreel to let station attendants move around longest truck-trailer combinations. It's nothing for a Diesel to take on 280 gallons of oil in one drink. Water and steam are used to knock off road dirt. As much as 1,300 pounds of dust and grime may be washed off a truck after an overnight run. Some stations have machines to blow crushed ice over loads of fresh meat, fruits, and vegetables.

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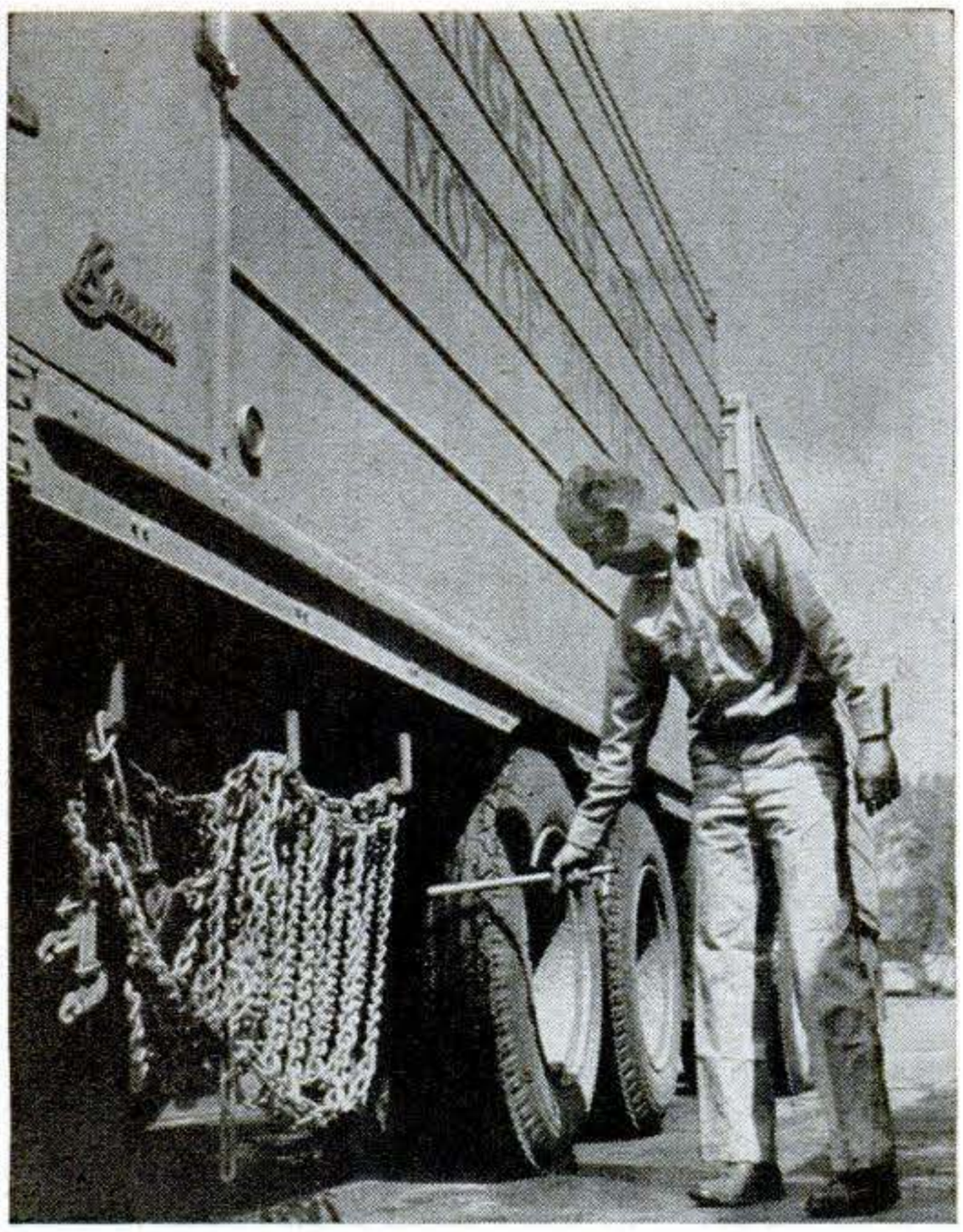
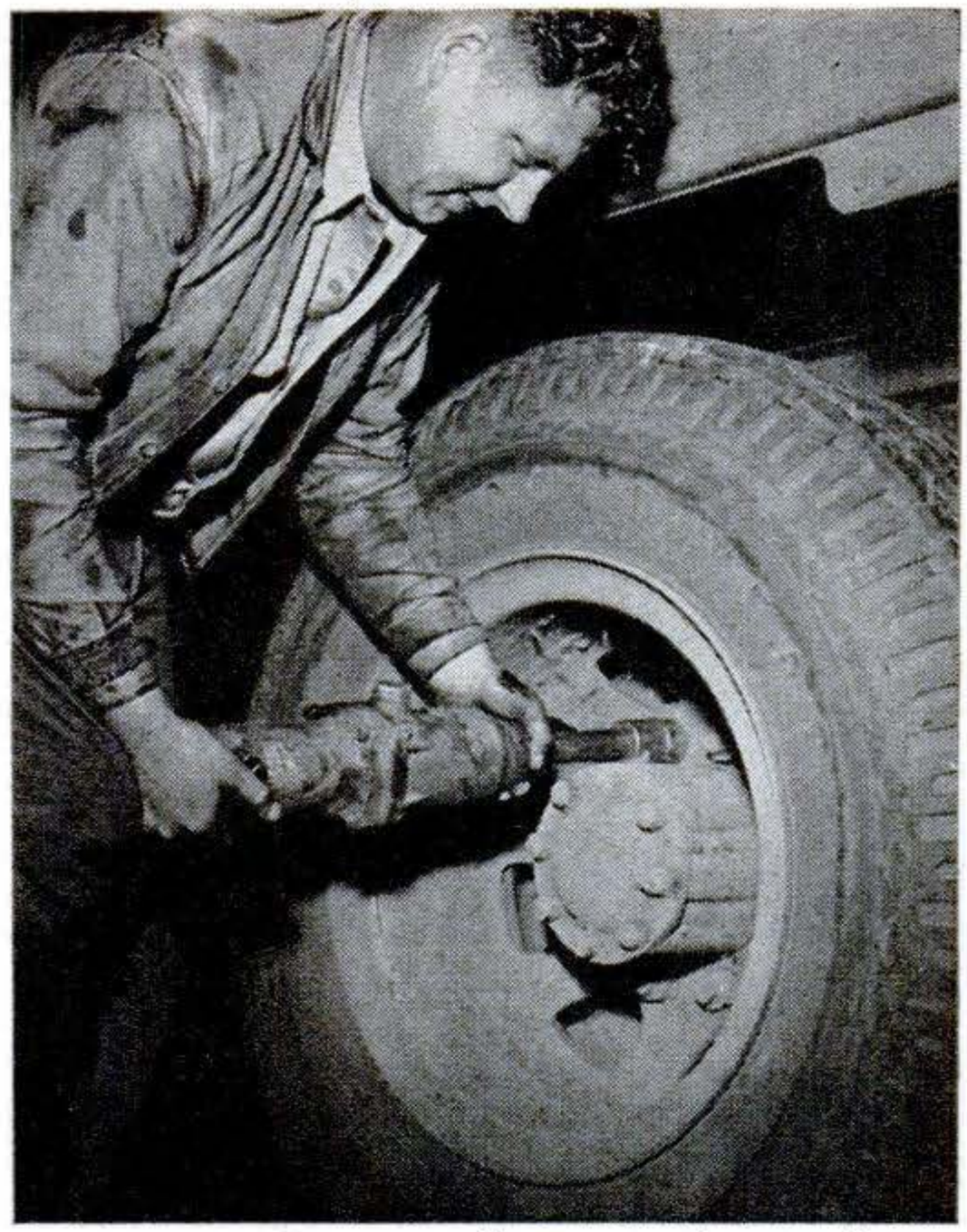
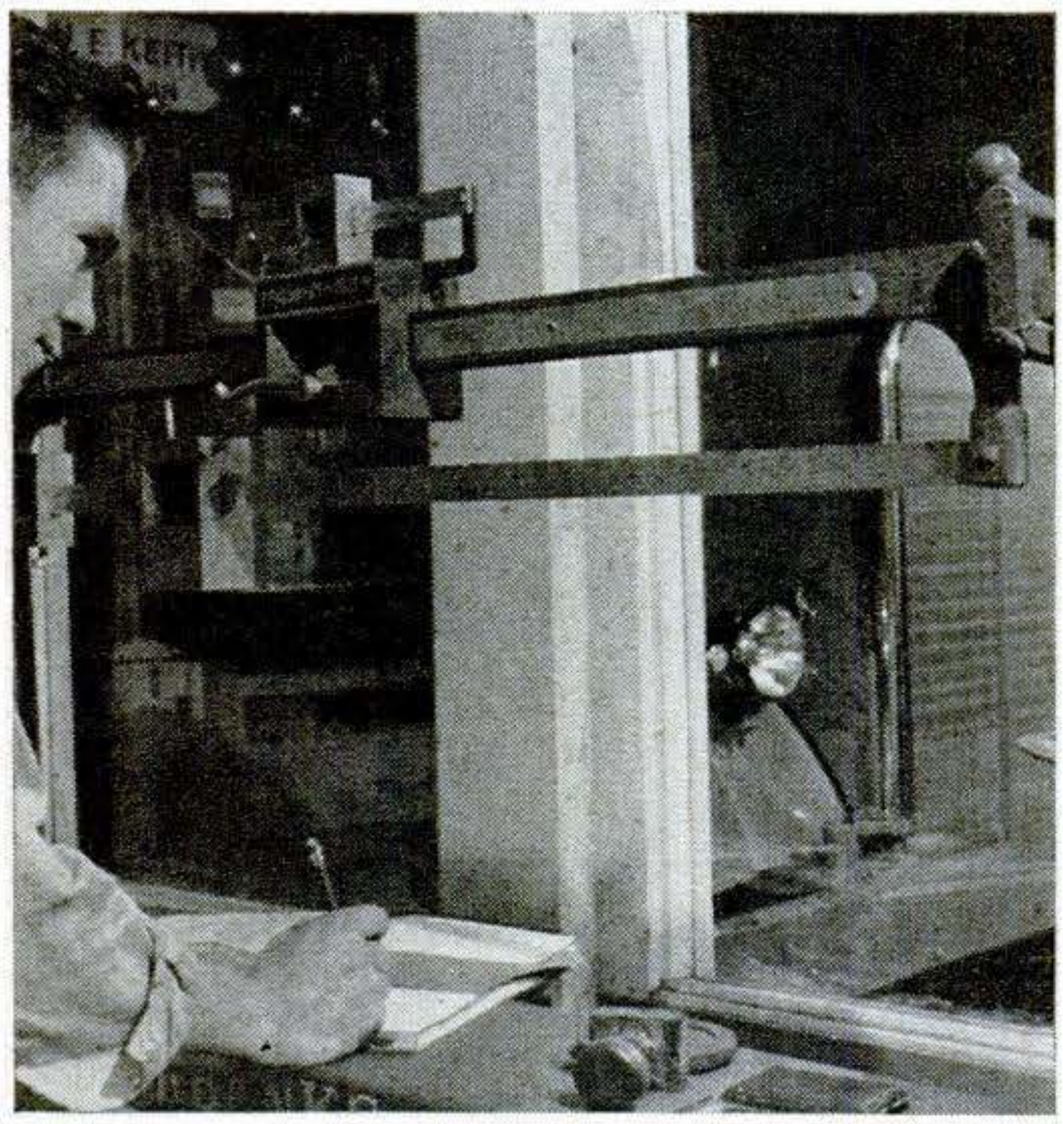


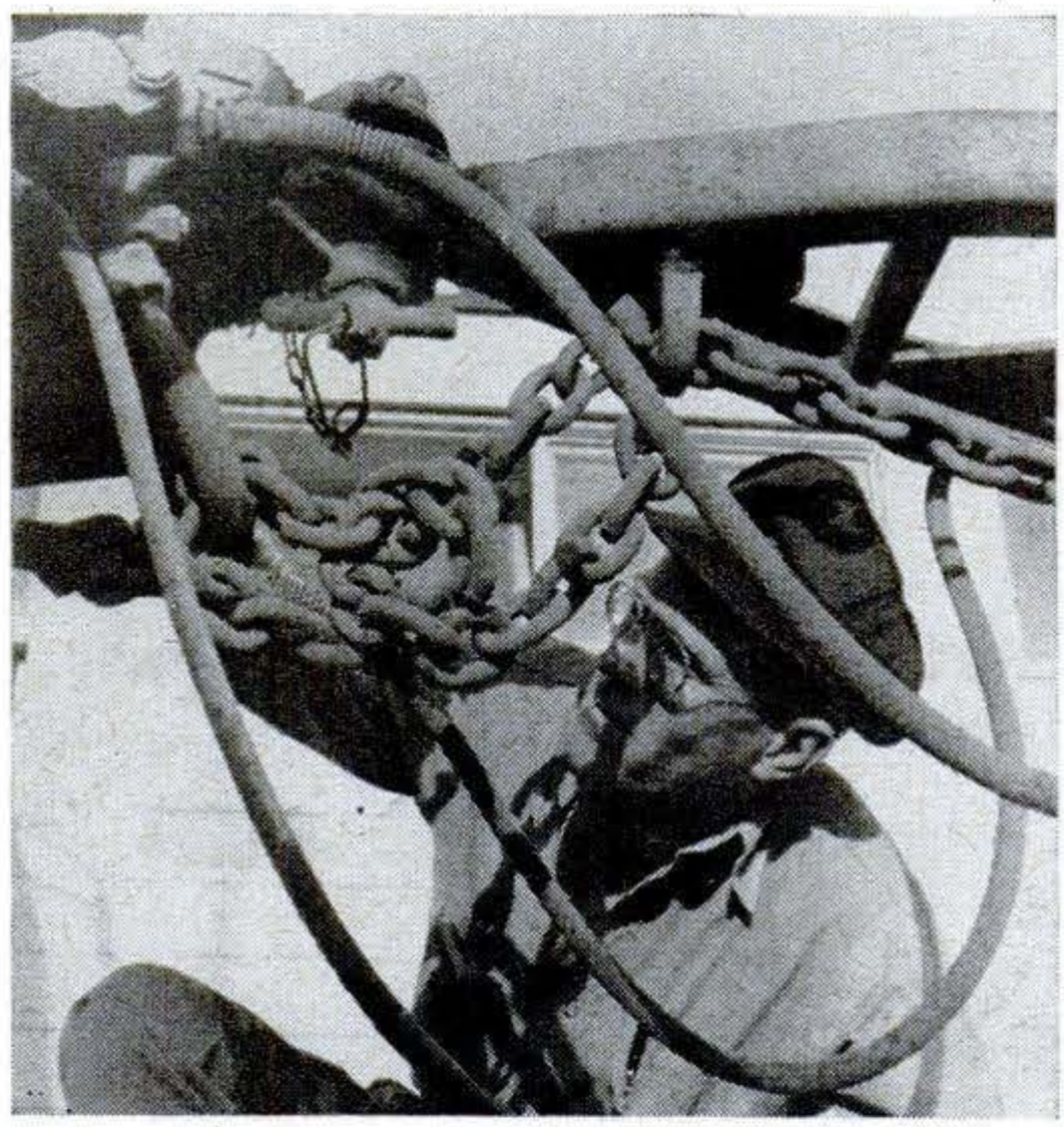
At each stop of highway freighter's cross-country trip, service-station attendant raps tires with an iron bar. The thud tells his experienced ear if pressure is up or down from normal 32 lb. On double wheels, this is easiest way to spot a flat—since either tire alone will support load. Some big "combos," carrying almost as much as a railroad car, have 22 tires. Heavy tire chains hang ready for use in mud or snow.



If a tire is flat, attendant uses this air-driven impact wrench to remove tight lug nuts. It jolts them loose, then unscrews them with successive raps. With such specialized tools, he can change one of these heavy-duty tires more quickly than you can pull a flat and put on the spare of your sedan. His fast work helps truckers keep up day-and-night schedules of close to 30 m.p.h., including all stops.



Attendant inside station weighs truck and its load on platform scale outside. Driver gets a copy of report to show inspectors who enforce widely varying state laws on size of highway transports. Biggest loads—43,000 lb.—are allowed in California, where a third of nation's truck-trailer combinations haul 3,000,000 tons of milk, 30,000,000 tons of other food a year.



Heavy-chain hitch stands ready to hold truck and trailer together if the regular coupling should snap. Hoses carry compressed air from cab to pneumatic brakes. Driver operates separate controls for truck and trailer brakes. Trailer-brake system carries heavier pressure, so it will take hold hardest and keep trailer from over-running truck on sudden stops.

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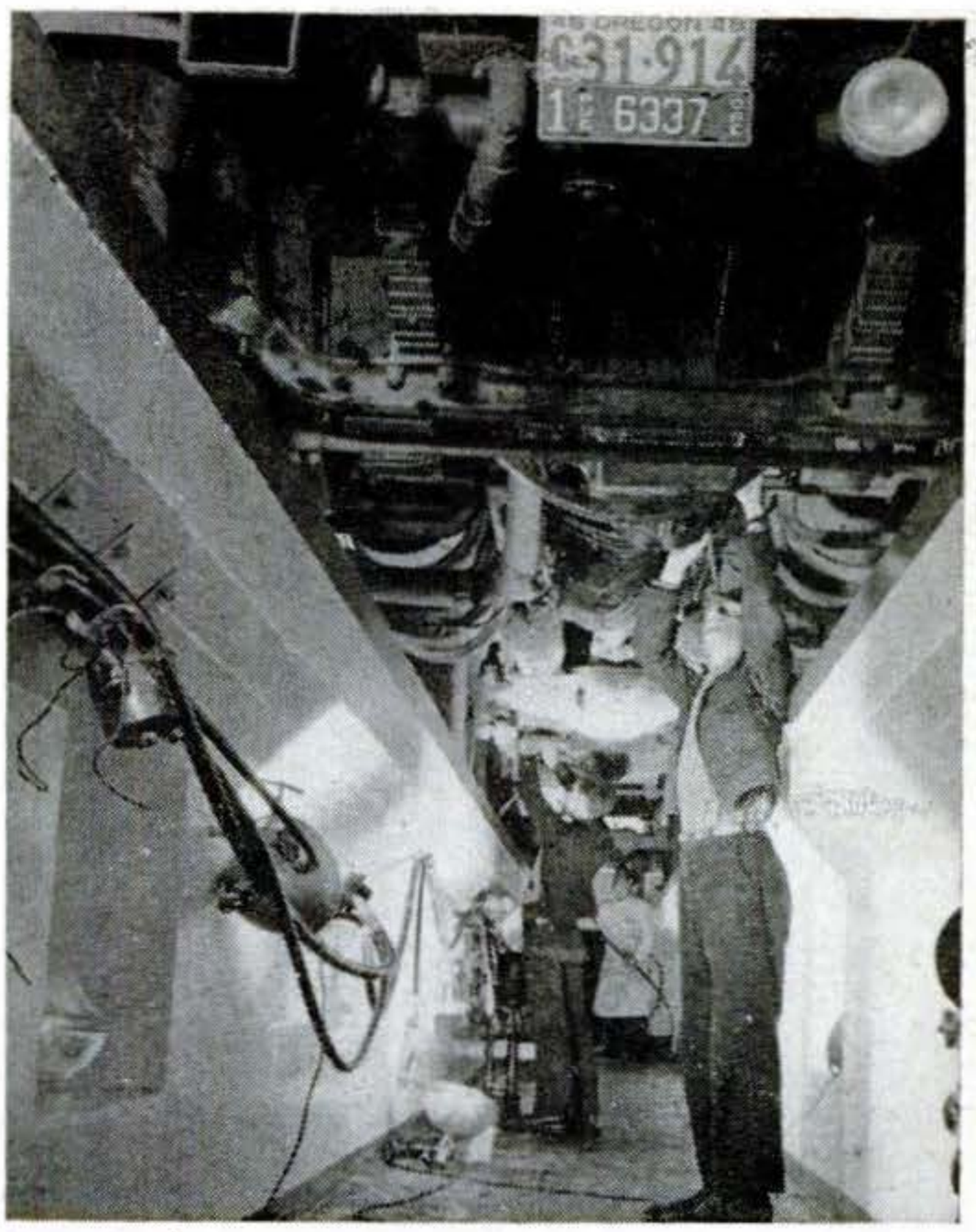
Steel arms of tire spreader, operated by pedal sticking out from base, hold beads apart while tube is removed. Either a hot or cold patch may be applied, and a few minutes later tire is ready to be put back on. A tire dolly, rolling on ball-bearing wheels, enables one man to lift 200-lb. wheel and tire from truck or trailer. In bad weather, he then trundles the entire unit into shelter of the station for repair.



Lubricating a big "combo" is a four-man job. This grease pit at a station in San Francisco is long enough to take four passenger cars. The war proved that, with proper care, trucks can run up terrific mileages. Diesels and butane burners get engines overhauled or replaced every 100,000 miles; some have gone 800,000 before they were ready for the junk heap. Break-in period for Diesels is 32,000 miles.

Driver makes out progress report on trip by truck licensed to operate from coast to coast.

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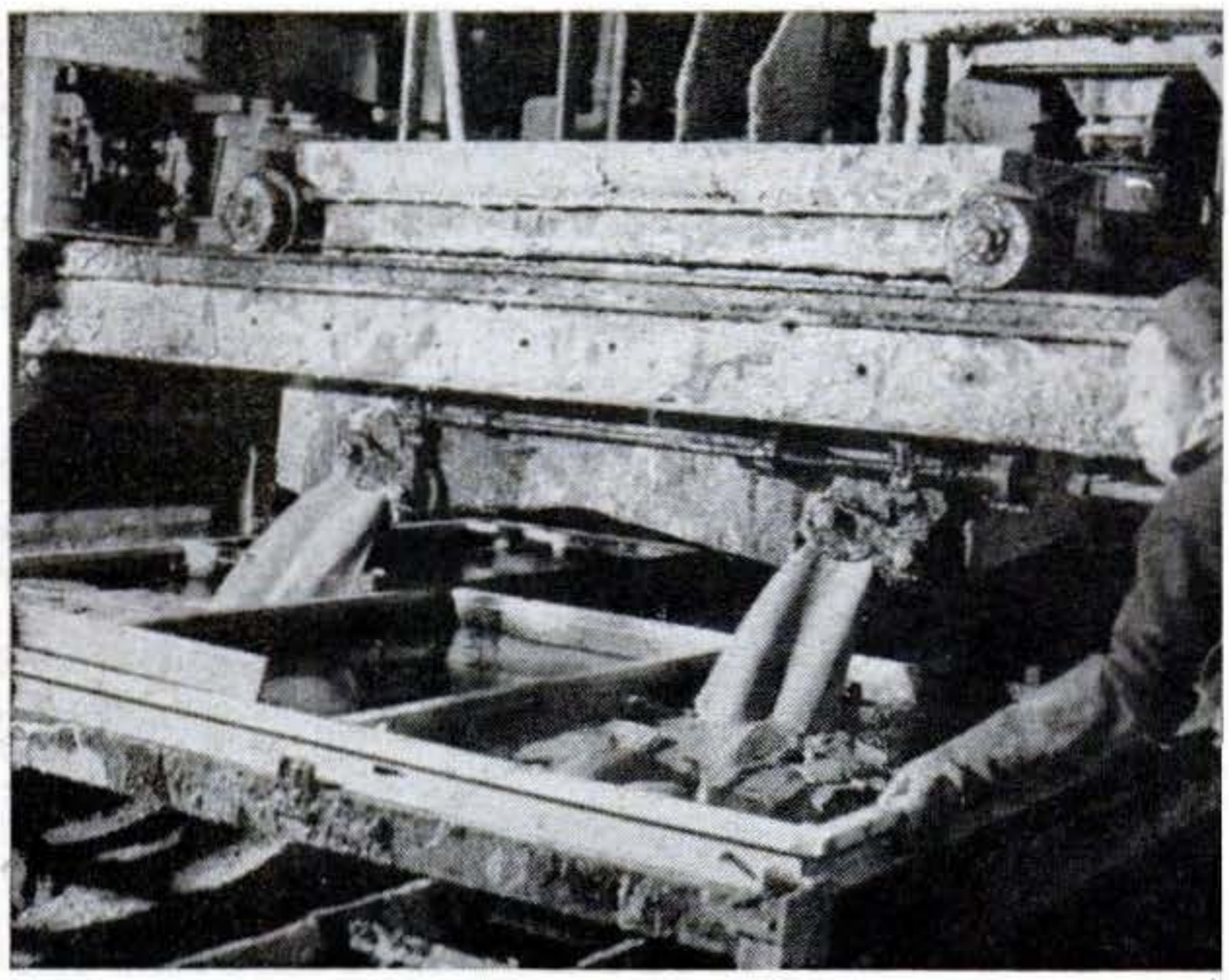
Production line at the Gloucestershire (England) factory of A. W. Hawksley, showing completed half houses. The prefabricated aluminum dwellings are constructed in sections, and then partially assembled in the plant. Note the line of roofs at right in the background.

Britain Exports Houses in Halves

BY HELPING to solve the housing shortage for other countries, Britain hopes to ease her own dollar shortage. Modern mass-production methods and aircraft manufacturing facilities are being used to turn out prefabricated aluminum houses. Adopting wartime-speedup methods, 3,000 employees of the Hawker Aircraft Co. turn out a house every 15 minutes. South America, Australia, and India are among eager customers.



Built-up wall panel of a house is filled with a special aerated cement. Next step will take it to a drying oven. Roof sections are built up on typical aircraft-type jigs—the result of the firm's experience gained during the war. Many of the workmen are war veterans.

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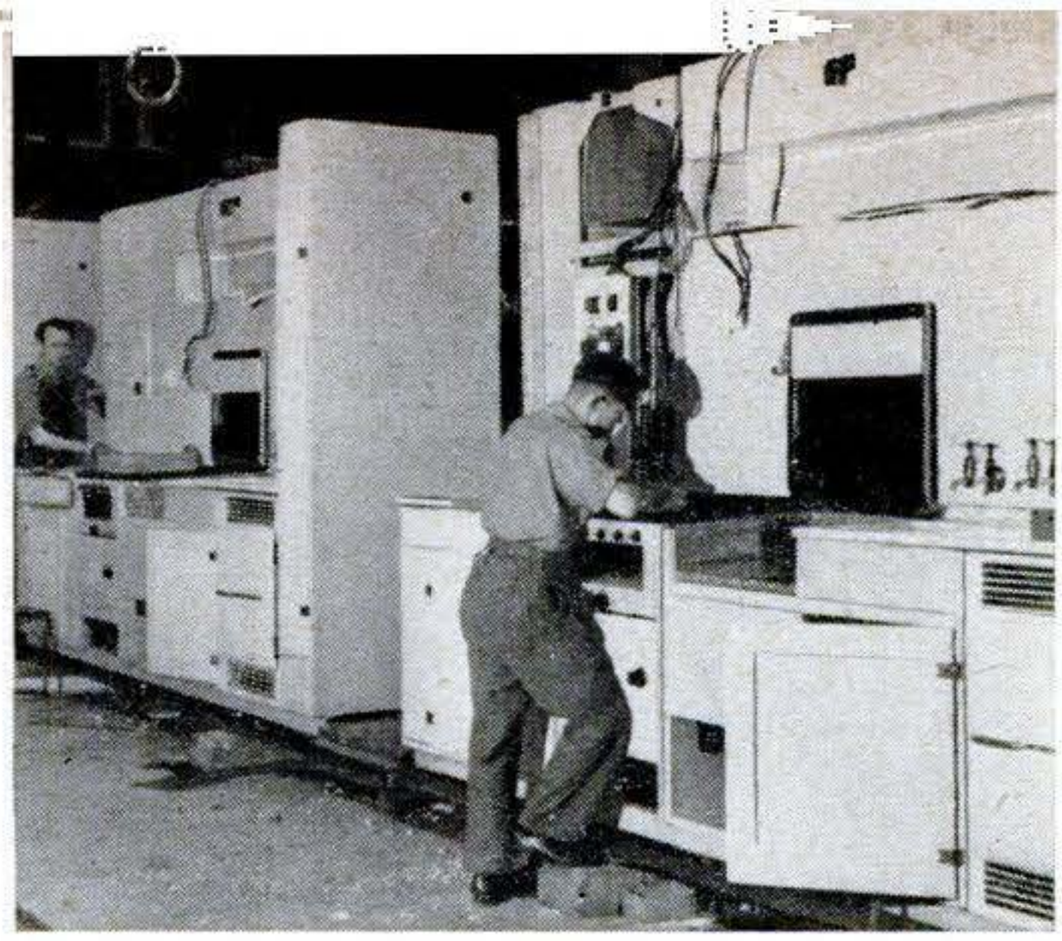
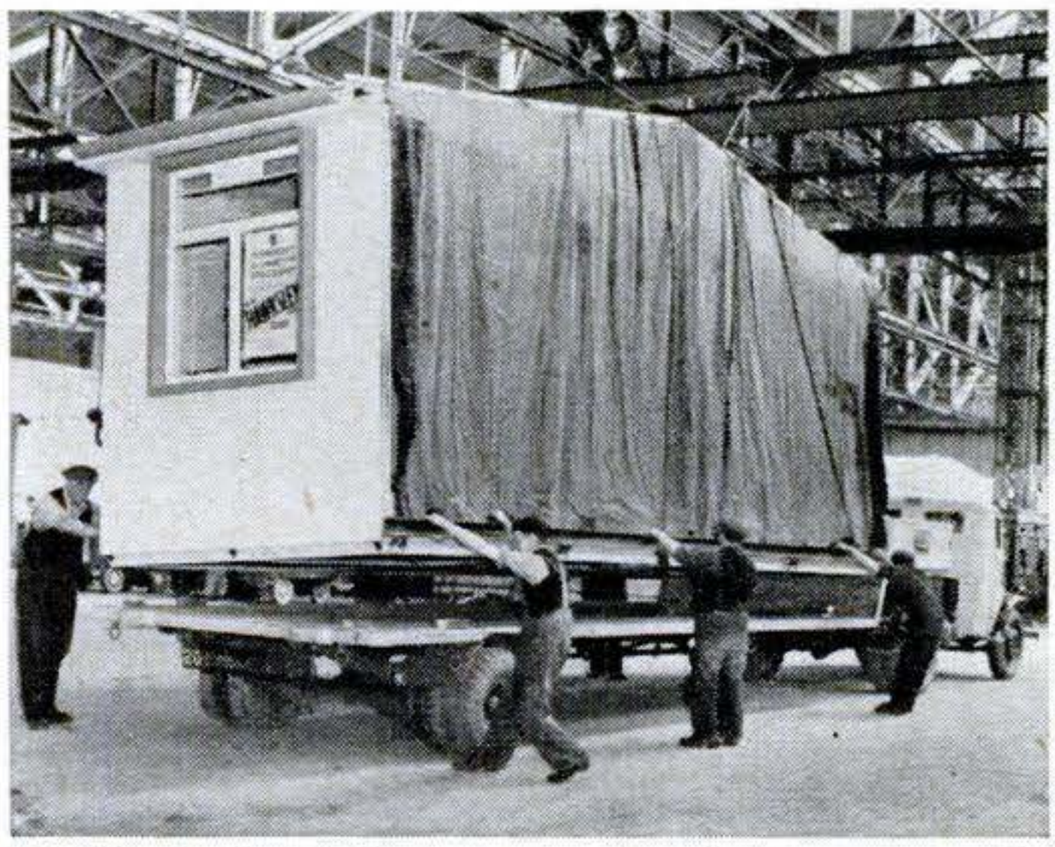
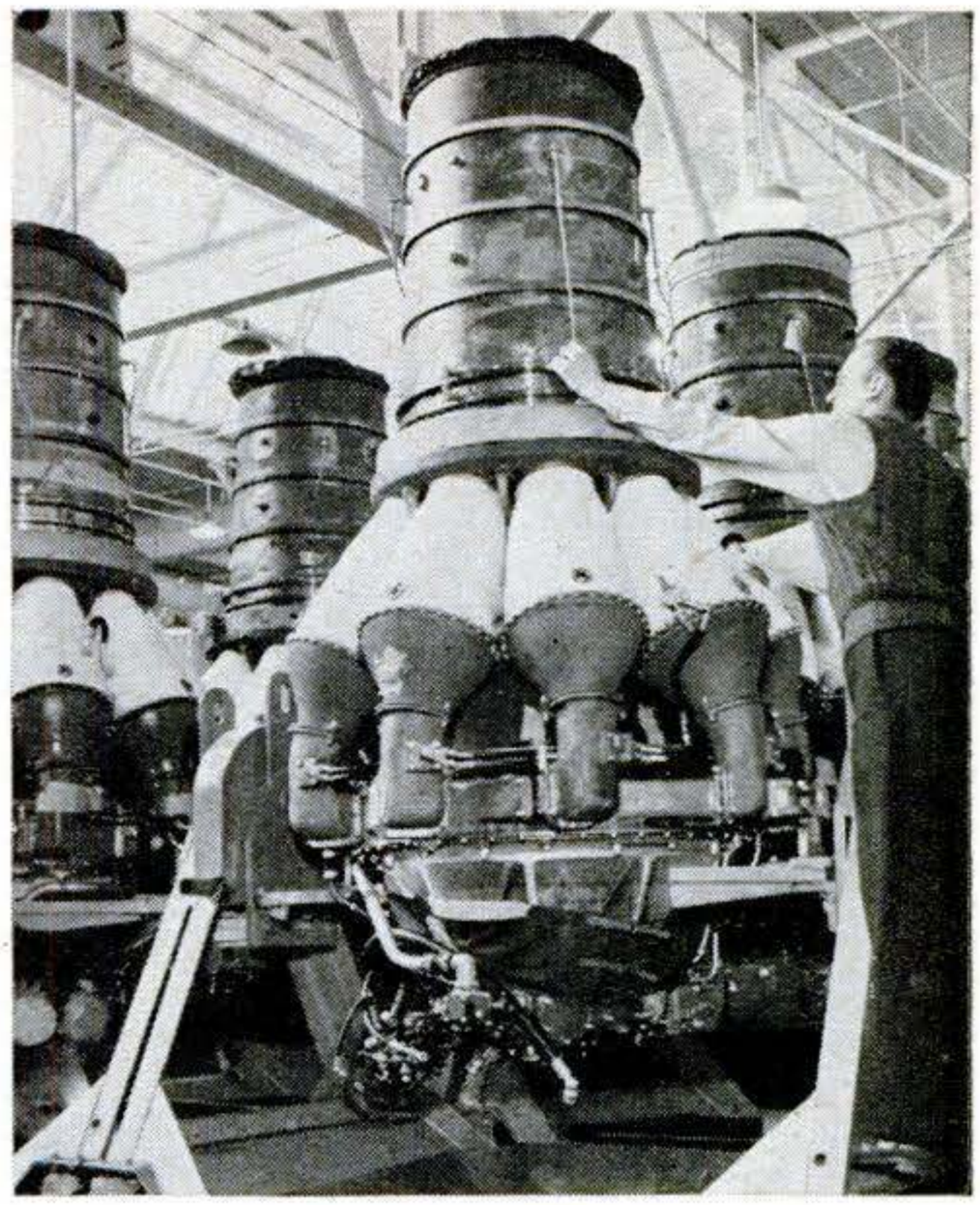


Along the production line, various sections of the houses are fitted with accessories. Men above are working on kitchen units. The houses are all-electric and have all modern conveniences, including refrigeration and bathrooms built right into the shell at the factory.



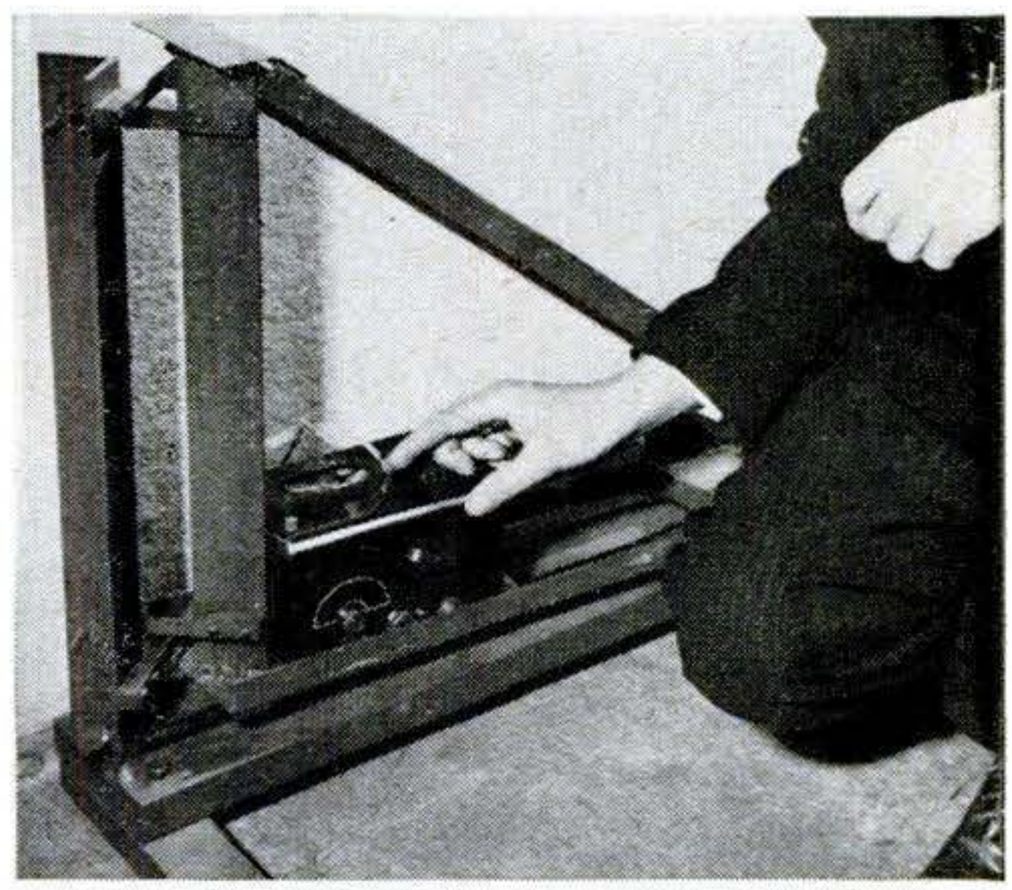
Finished half houses are loaded onto trucks in the factory and covered in preparation for shipment. Although Britain has her own housing shortage, the need for foreign exchange is greater, so these houses are earmarked for export. There is no shortage of customers.

At the building site, erection of the house presents no problem. The two halves, one of which is shown above being put into place, can be locked together and be ready for occupancy in two hours. Even painting and complete interior finishing has been done at the factory.



More Power for Navy Jets

UPENDED for inspection, this new Pratt & Whitney Turbo-Wasp® is the most powerful jet engine produced in America. It is rated at 5,000 pounds of thrust, which, at speeds of more than 600 m.p.h., is the equivalent of 9,000 hp. First production models of the JT-6B will be installed in F9F-2 carrier-based fighters.



Meter Measures Vibrations

THE new portable "seismograph" above is being used to study how vibrating machinery shakes a factory wall. The device uses the principle of earthquake recorders. Set against the wall, a prod vibrates a Barry seismic pendulum. A Westinghouse Vibrograph® then records the vibrations on transparent plastic tape.

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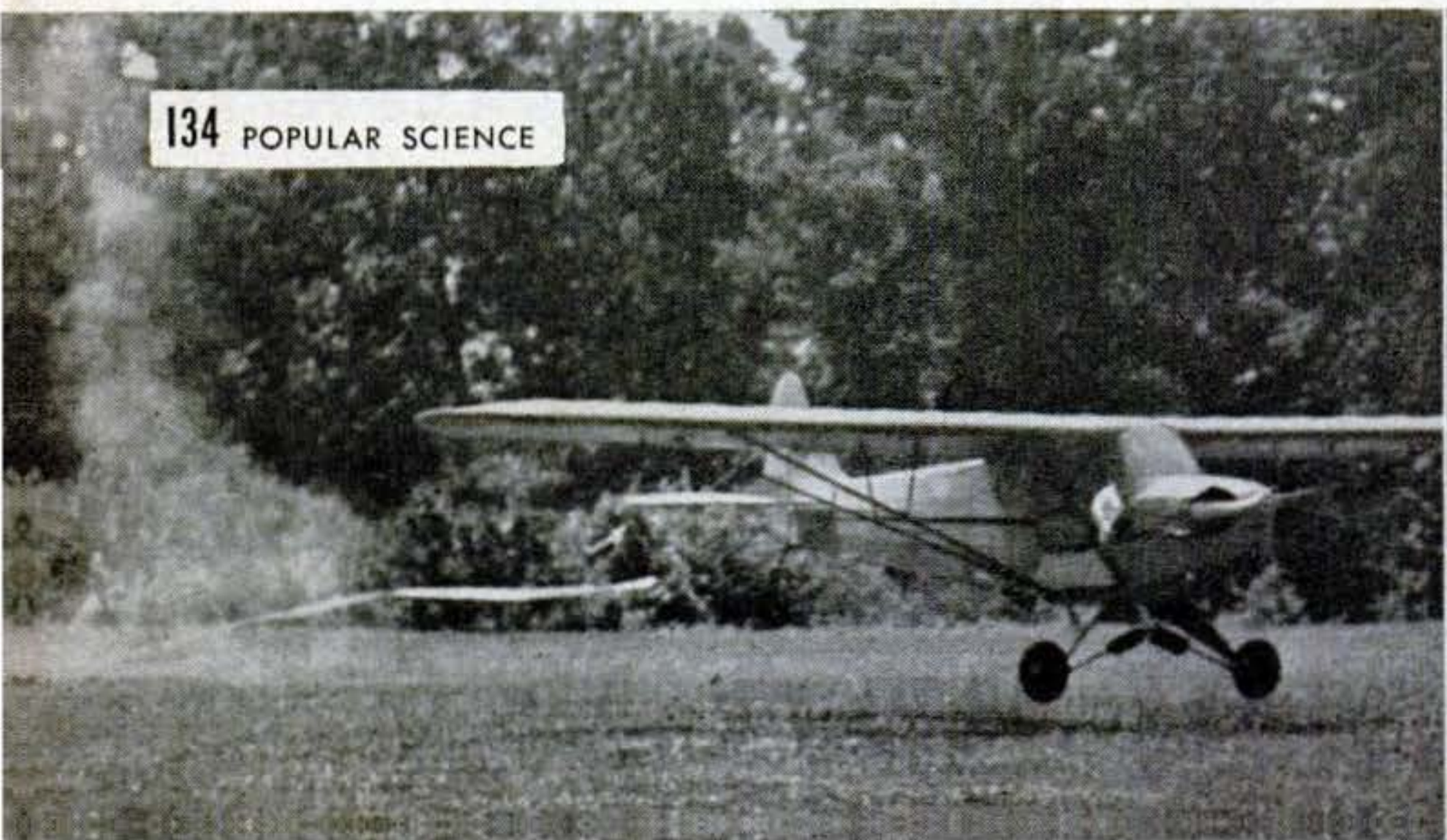
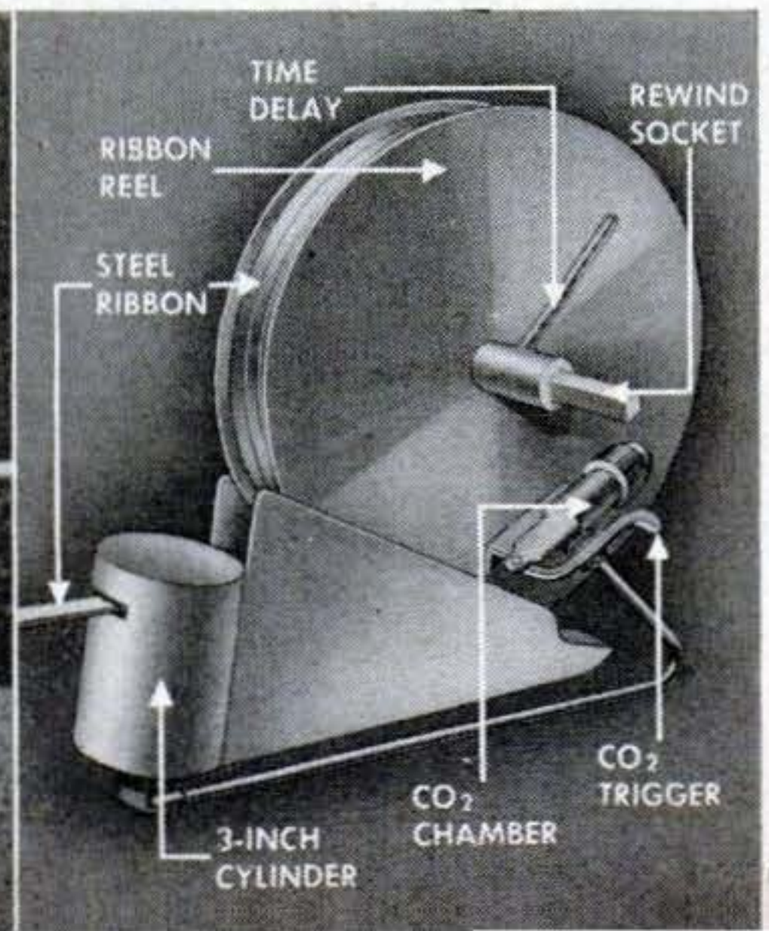
Flying Lying Down. This Air Force sergeant is trying out a "prone-position bed for pilots." A later model has been installed in the nose of a B-17 to test how this position will raise a pilot's "blackout threshhold," permitting quicker maneuvers, sharper turns, and faster pull-outs. At left is a prone-piloted, experimental Northrop XF-79 jet fighter.

Brake Shot into Ground. The photo below, at left, shows how a new arresting anchor is shot into the ground from a plane about to land. Fired by a charge of gunpowder, the anchor pulls out a stainless steel ribbon that unreels through friction-brake shoes. Together, they bring a 1,200-lb. plane, landing at 70 m.p.h., to a stop in a tenth of its normal 1,000-ft. ground roll. The 18-lb. mechanism, shown at right below, was developed by All American Airways, Inc., of Wilmington. Used here on a Piper Cub, it's adaptable to heavier planes. The brake shoes are applied by compressed CO_2. They can be small since most of the friction heat is carried off by the ribbon.





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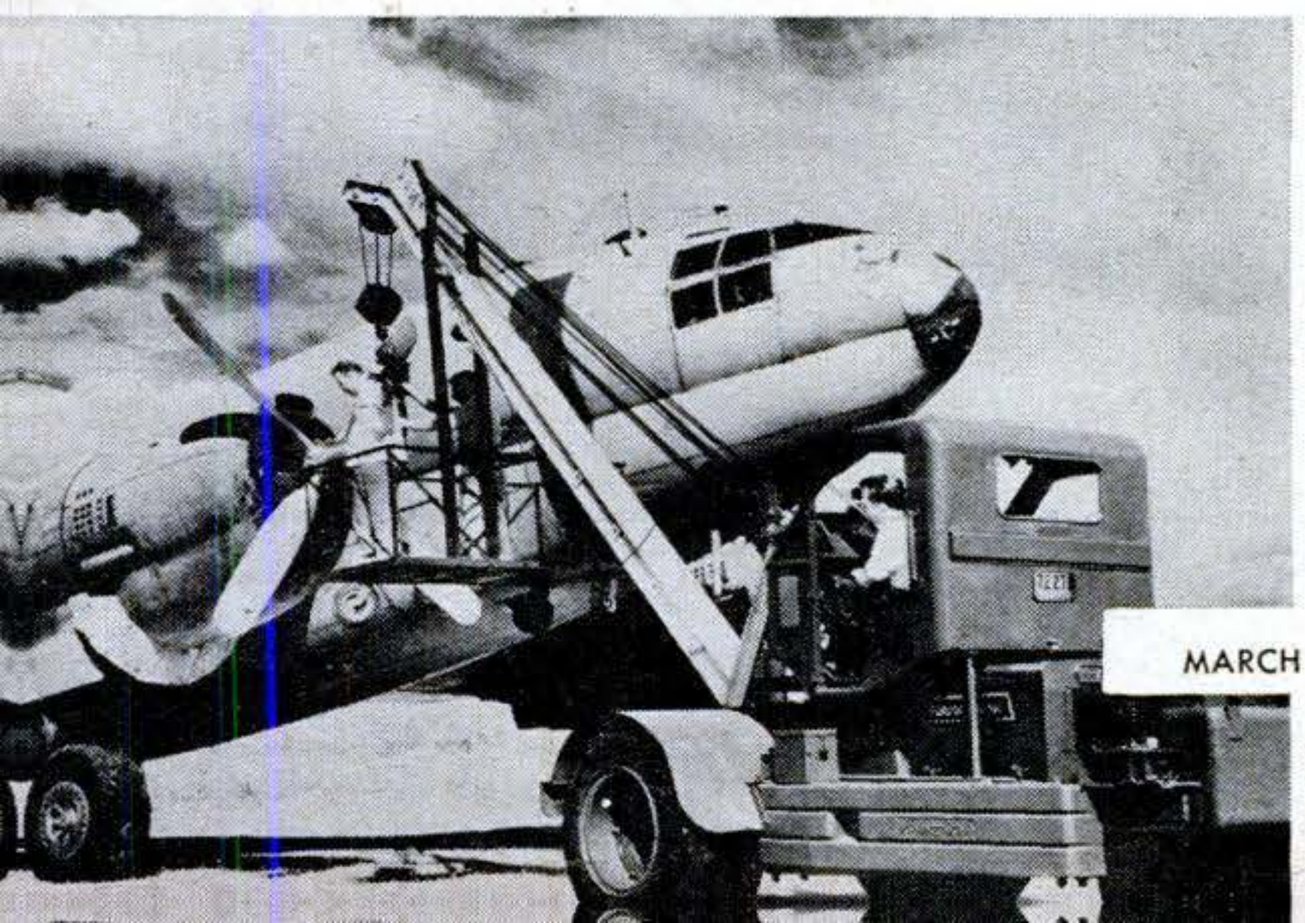
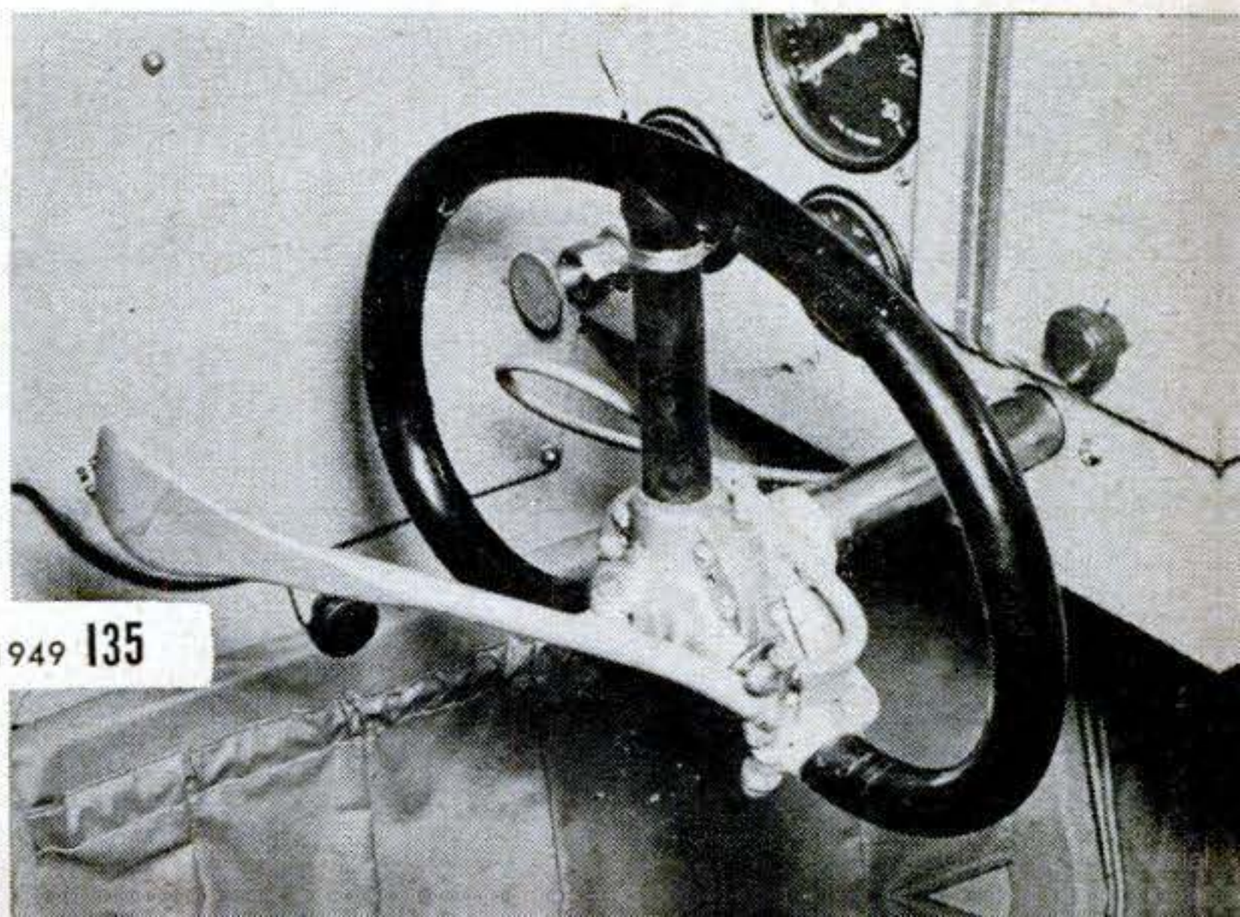
Tail-less Fighter Is Fast. This twin-turbojet fighter, designed for carrier operation, goes more than 600 m.p.h. It is the Navy's new Chance Vought XF7U-1. Two vertical stabilizers and rudders are in the trailing edge of the wing. The plane is turned both horizontally and vertically by a pair of "ailevators," combining the work of ailerons and elevators. Leading-edge slats do the job of landing flaps. Hydraulic jacks operate all controls. In combat, bursts of high speed can be obtained through afterburners. The plane is kept light by a maximum use of magnesium. It has a pressurized cockpit and an ejectable pilot's seat for bailing out at high speeds.

Servicemen Get Airlift. Below, an ordinary crane truck puts into position a new kind of working platform for installation and maintenance of Hamilton Standard propellers. The boom can hoist the platform up to 26 feet, while the prop is raised or lowered by a cable. In transport, the platform is towed behind the truck.



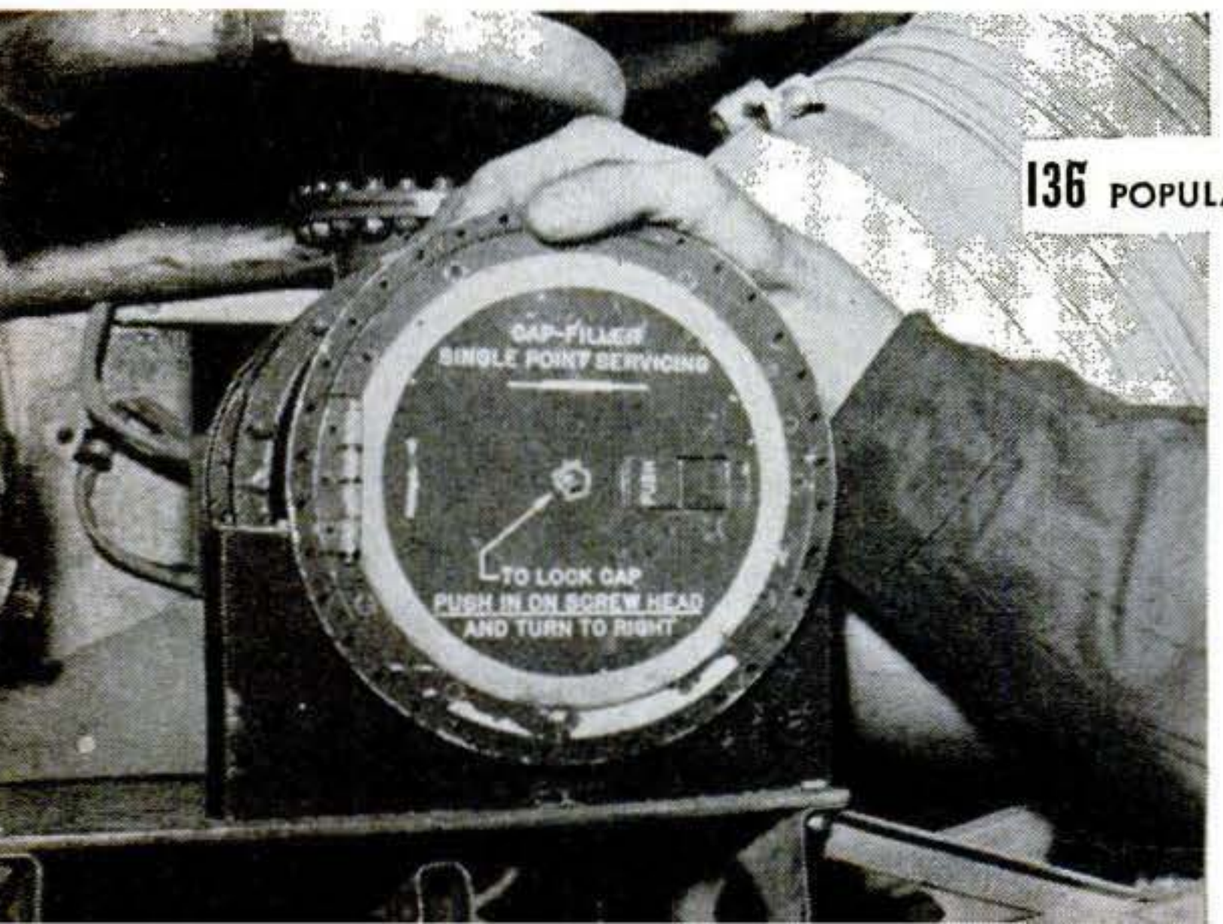
Handle Replaces Foot Brake. Designed for handicapped pilots, the hand grip attached to the control wheel of this Ercoupe® (below) operates the brake and eliminates need to use the plane's only foot pedal. Made by the Grand Central Airport Co., of Glendale, Calif., it enables the plane to be flown entirely with the hands.

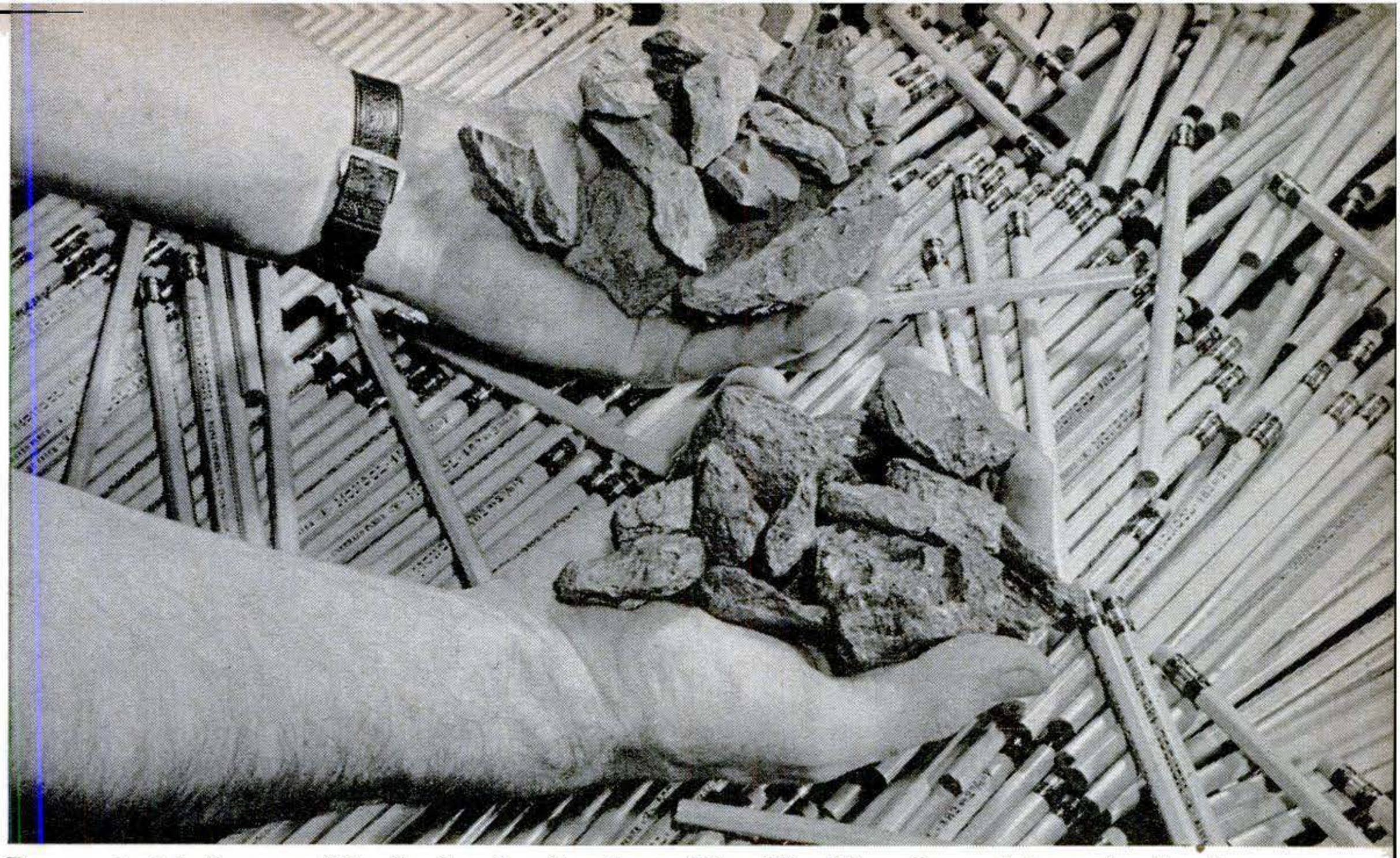


Off in a Burst of Smoke. With a powerful jet-assisted kick, a Lockheed P2V Neptune, the largest plane ever to take off from a carrier, lifts its wheels from the deck of the USS *Coral Sea.* Two of the twin-engine search-patrol planes were used in a recent successful test. Both were unmodified operational versions and, since neither was equipped for carrier landings, came down at a nearby Naval air station.

Aircraft Refueling Speeded Up. With a new Air Force continuous-flow fuel system, all tanks of the largest bomber can be refueled from the single point shown below. At present, the B-29 has 11 servicing points for its 29 fuel tanks. Using the new system, one man with one truck can do in 30 minutes a refueling job that previously took 13 men with four trucks 45 minutes. In flight, it provides a continuous flow of fuel from all tanks to all engines without the crew having to remember to switch tanks. The Air Materiel Command says present air-to-air refueling would be impossible without the new system.

Small Plane Has Twin Tail. Designers of the new pusher-type personal plane shown below say that mounting the tail on twin booms improves its performance by reducing drag through use of a shorter body. Now being test-flown by Anderson, Greenwood & Co. at Houston, Tex., the two-place plane is powered by a Continental C-90 engine mounted behind the cabin and connected directly to a pusher propeller. This arrangement gives both pilot and passenger unrestricted vision and is said to cut cabin noise. The all-metal plane has a steerable tricycle landing gear. Top speed is 120 m.p.h.; range is over 400 miles.





Raw materials for pencil lead: clay (top) and graphite. Wood is soft, straight-grained cedar.

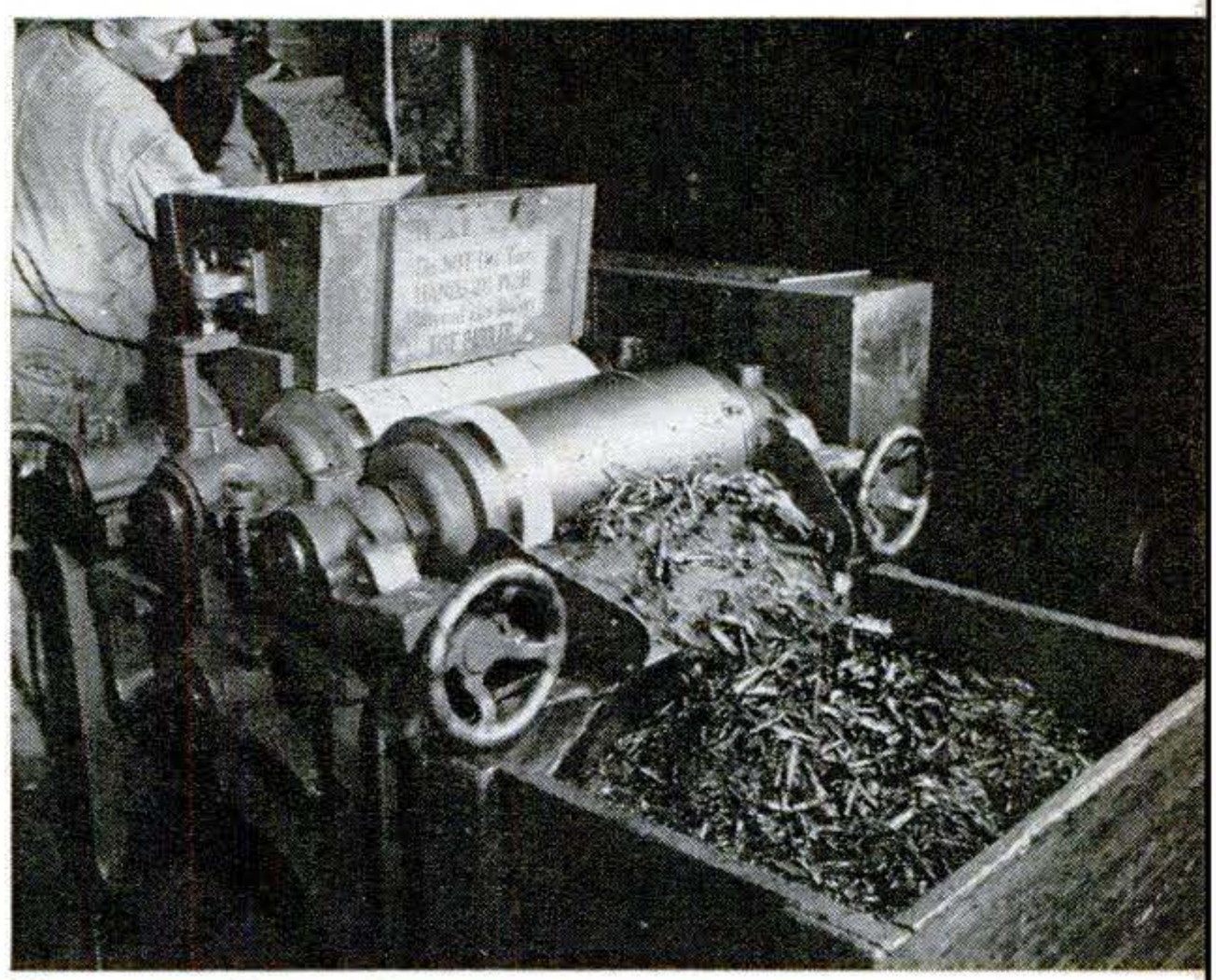
Pencils Made By the Billion

PS photos by Hubert Luckett

THAT pencil in your pocket is one of more than a billion made in the U. S. each year by a highly mechanized process that is surprisingly complicated for so simple a product. The materials come from the mines and forests of four continents.

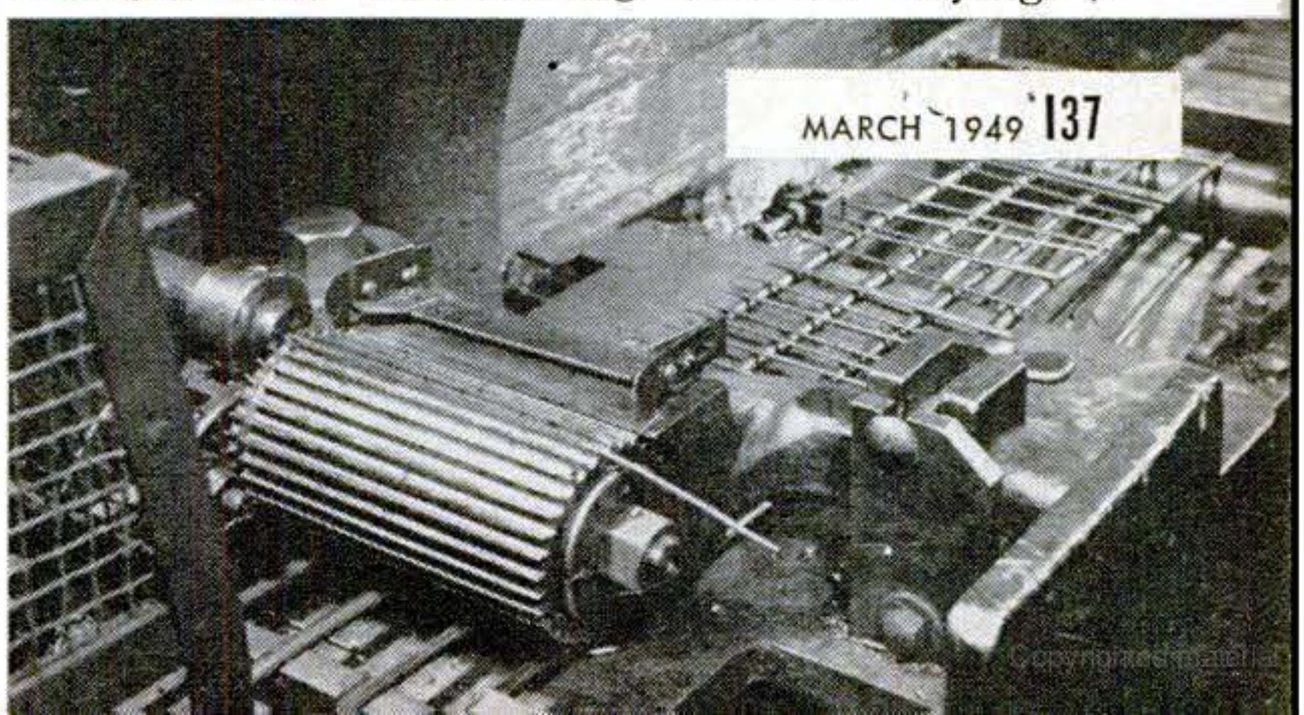
The business part of any pencil, its lead, is graphite fused with clay. The percentage of clay determines its hardness. For soft grease pencils, wax is added. The softer the lead, usually, the bigger its diameter—to keep it from breaking. Colored leads contain dyes and a filler that is a secret with each manufacturer.

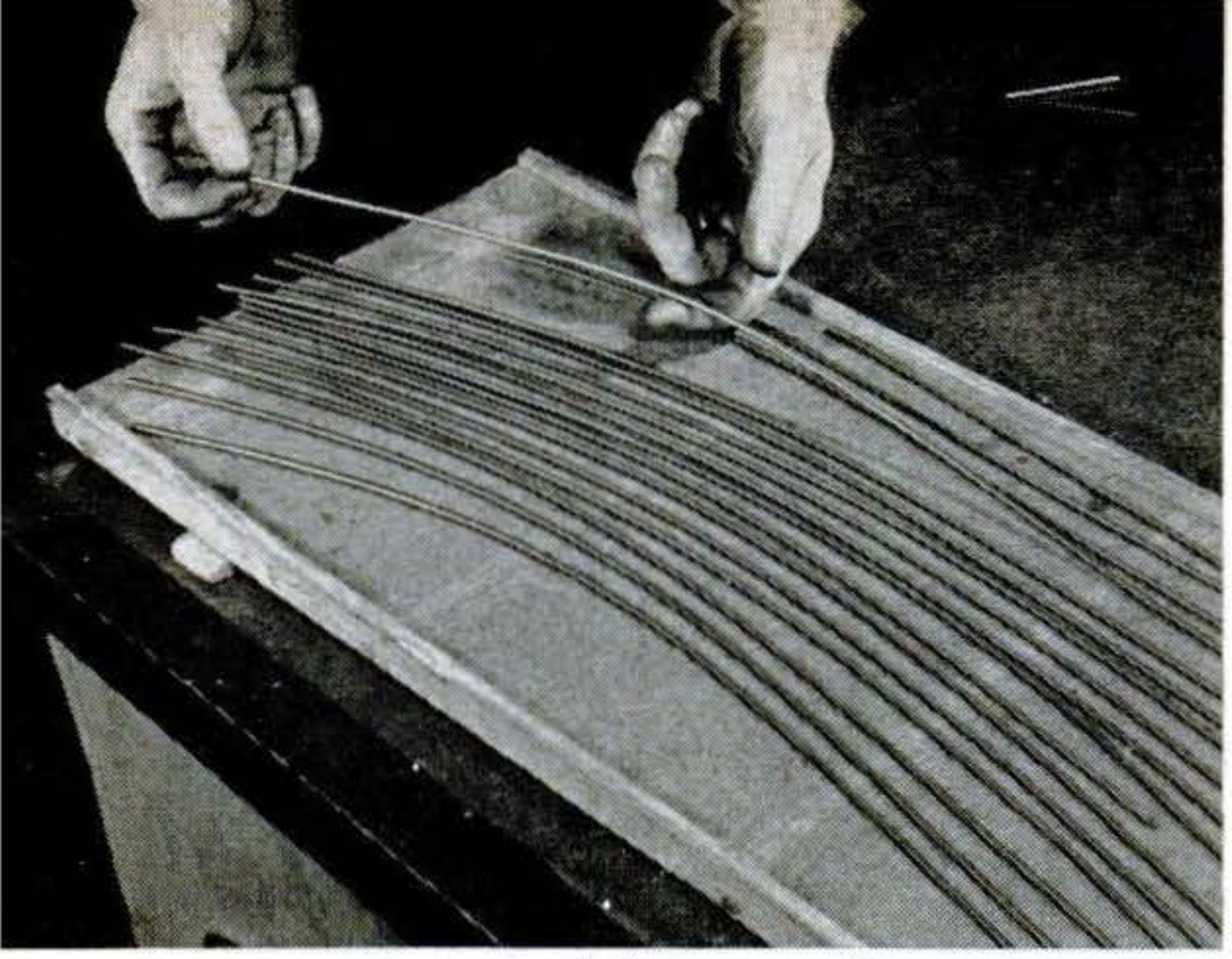
In the Brooklyn factory where these pictures were taken, the 100-year-old Eberhard Faber Pencil Co. can turn out 860,000 pencils in an eight-hour day. They come in more than 1,000 types and 70 tints—including women's eyebrow pencils.



Mixture of graphite and clay is put through series of mechanical and chemical processes to refine and pulverize it. Here pellets are being milled to give lead finer consistency.

Extruding machine (below) presses compound through a die to make long, slim lead. Receiving roller cuts off sections. These ride conveyer into heat-treating unit for drying.

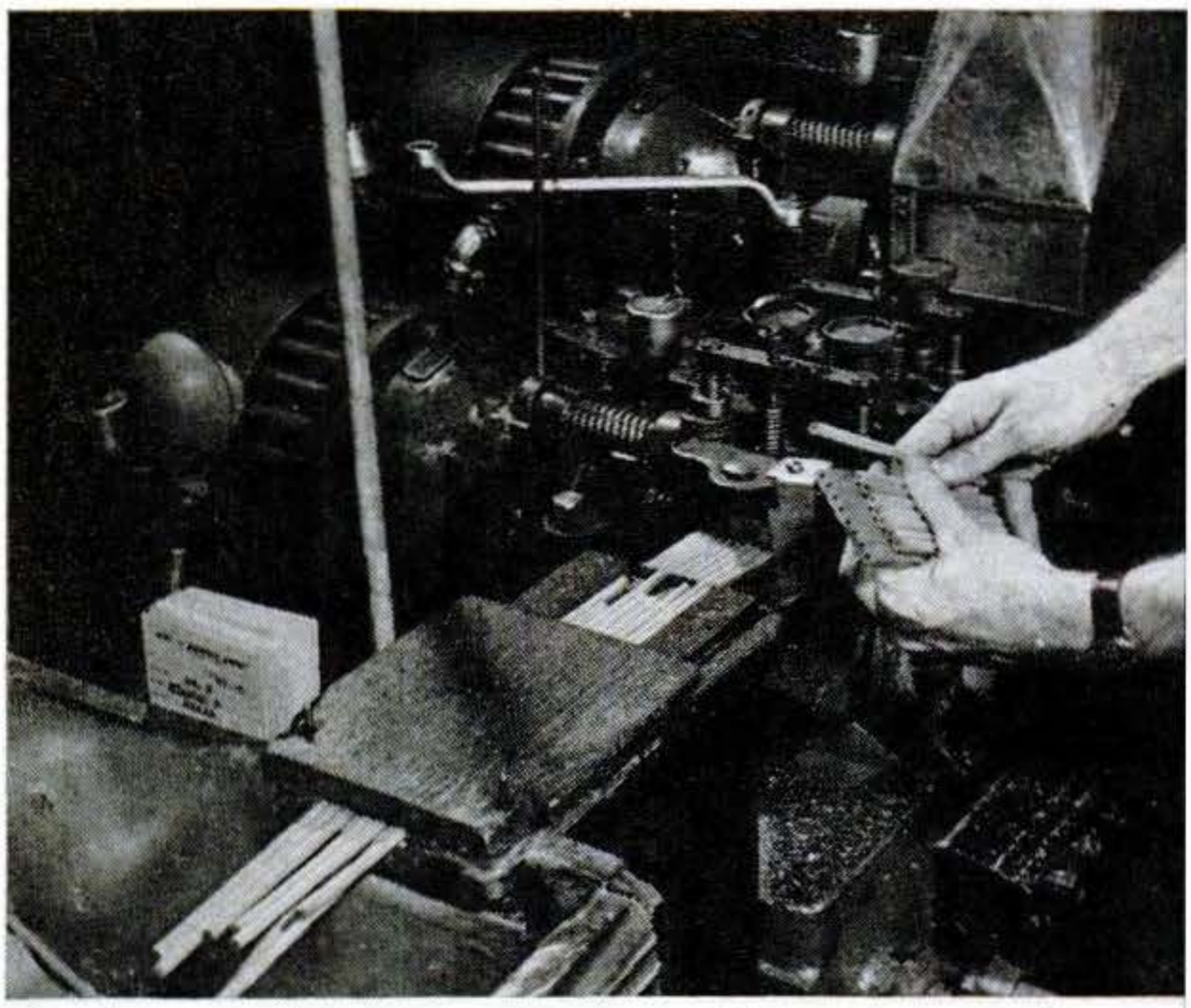




Uncut leads, fresh from extruding machine, are fragile yet—as you can see in this picture—limber. Before being cut to pencil length and hardened, they are straightened by rolling.

Bunches of leads are wrapped in a special paper and put into crucibles for firing. Charcoal is sifted around them on agitator table as packing to prevent their warping under heat.

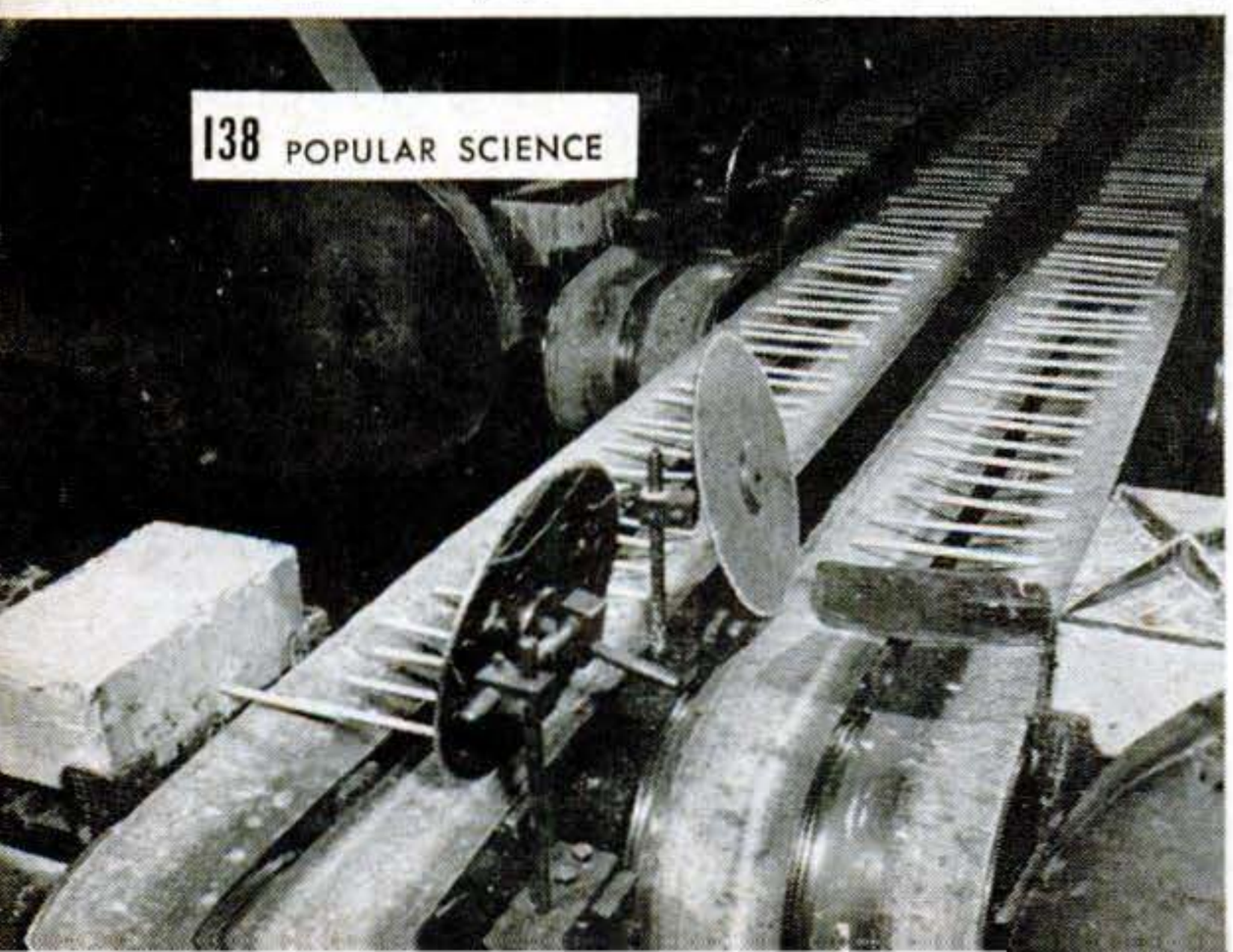
Leads are laid in grooves of slat by hand or machine. Glue is then spread on face of the slat, and a similarly grooved top slat is pressed on to enclose the leads in a sandwich.



Cutting machine, operating at 15,000 r.p.m., slices up slats at rate of 130,000 pencils a day. It also shapes pencils round or hexagonal. Operator here holds a slat and cut pencils.

Rough pencils are coated 5 to 15 times by shoving them through reservoirs of lacquer (below) onto drying belts. Circular plates beside belts stop pencils as they shoot from baths.

In factory laboratory, leads taken from production line are ground down on this turntable (below) to determine their wearing qualities. Another machine tests leads for strength.



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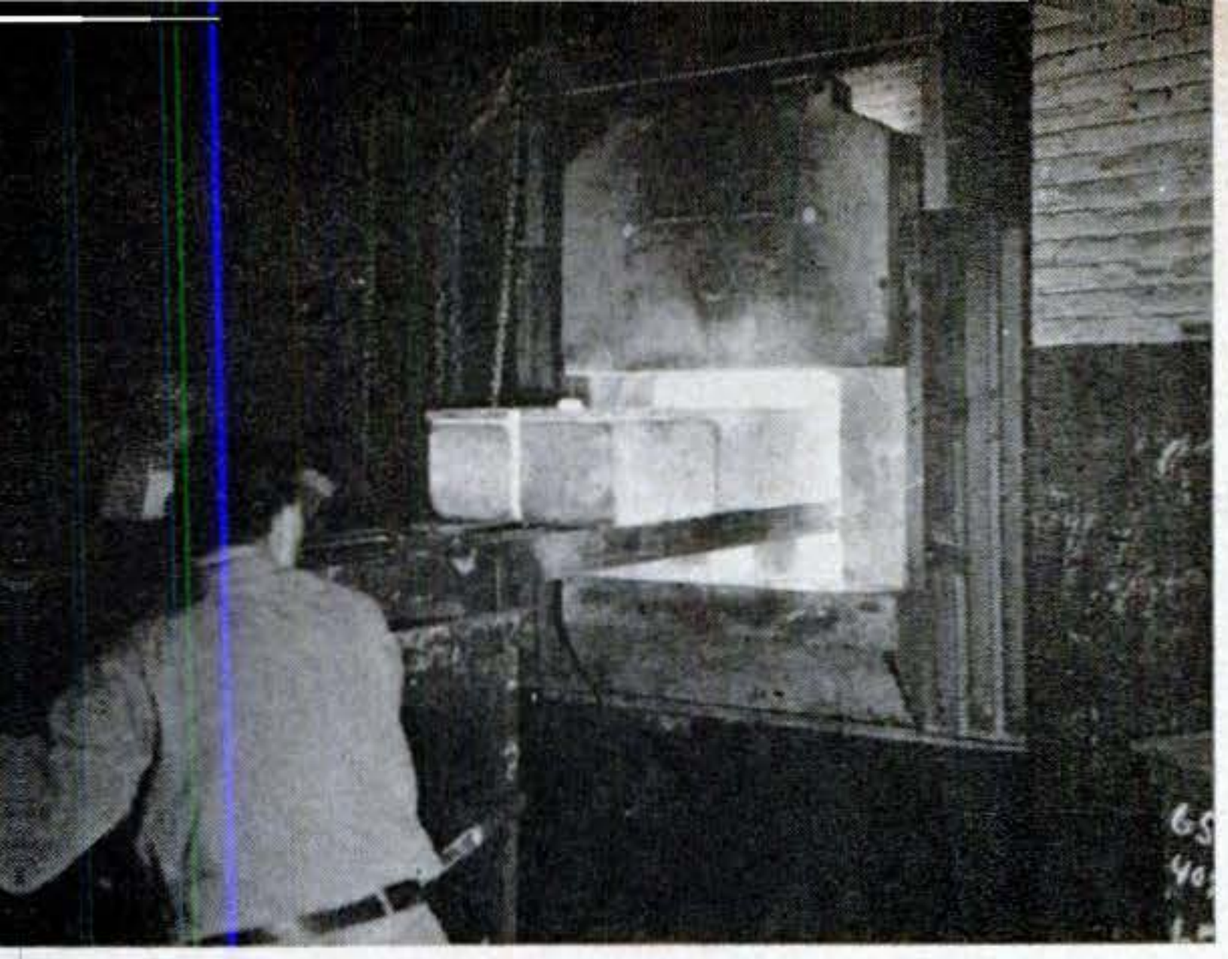
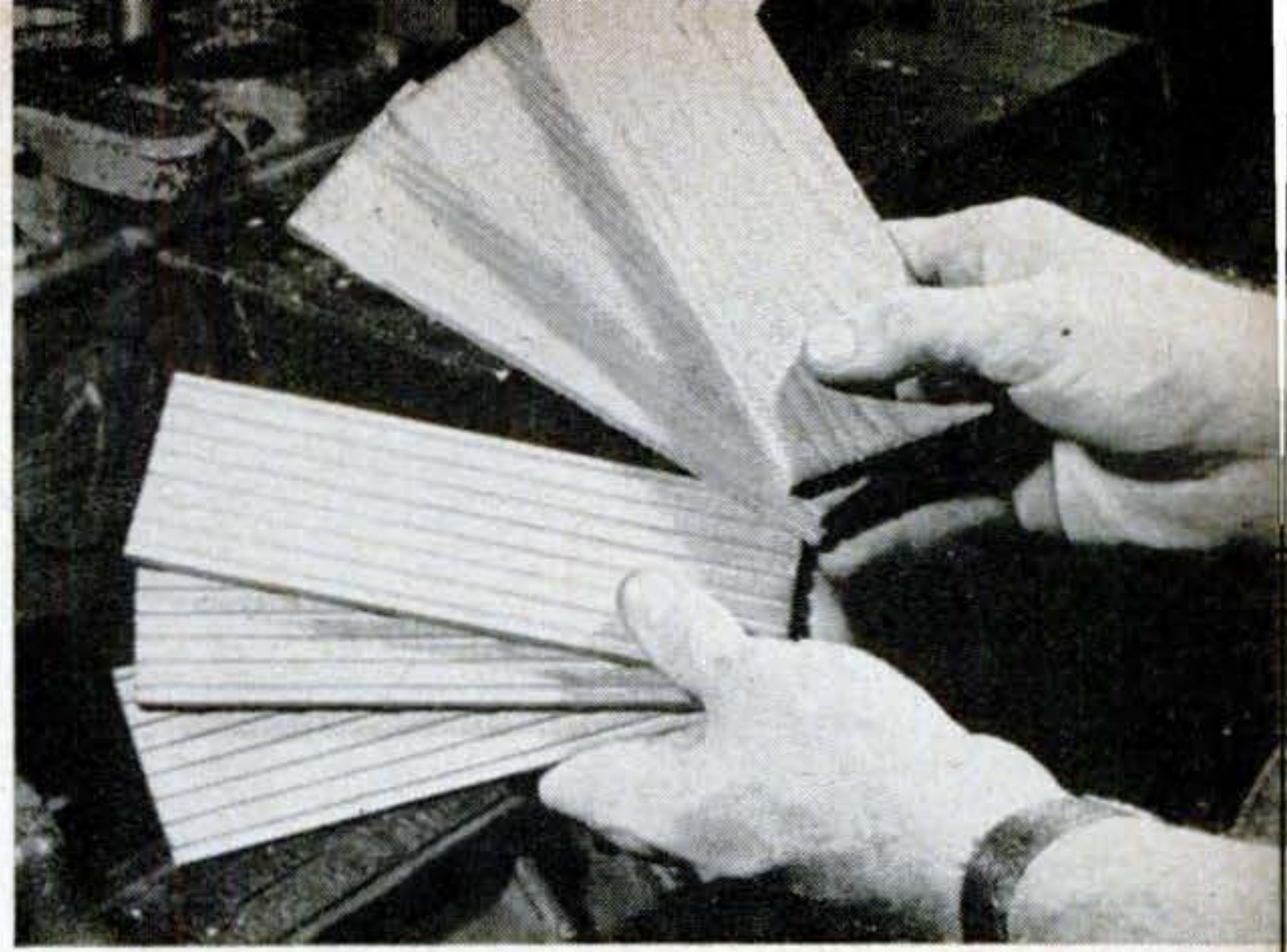
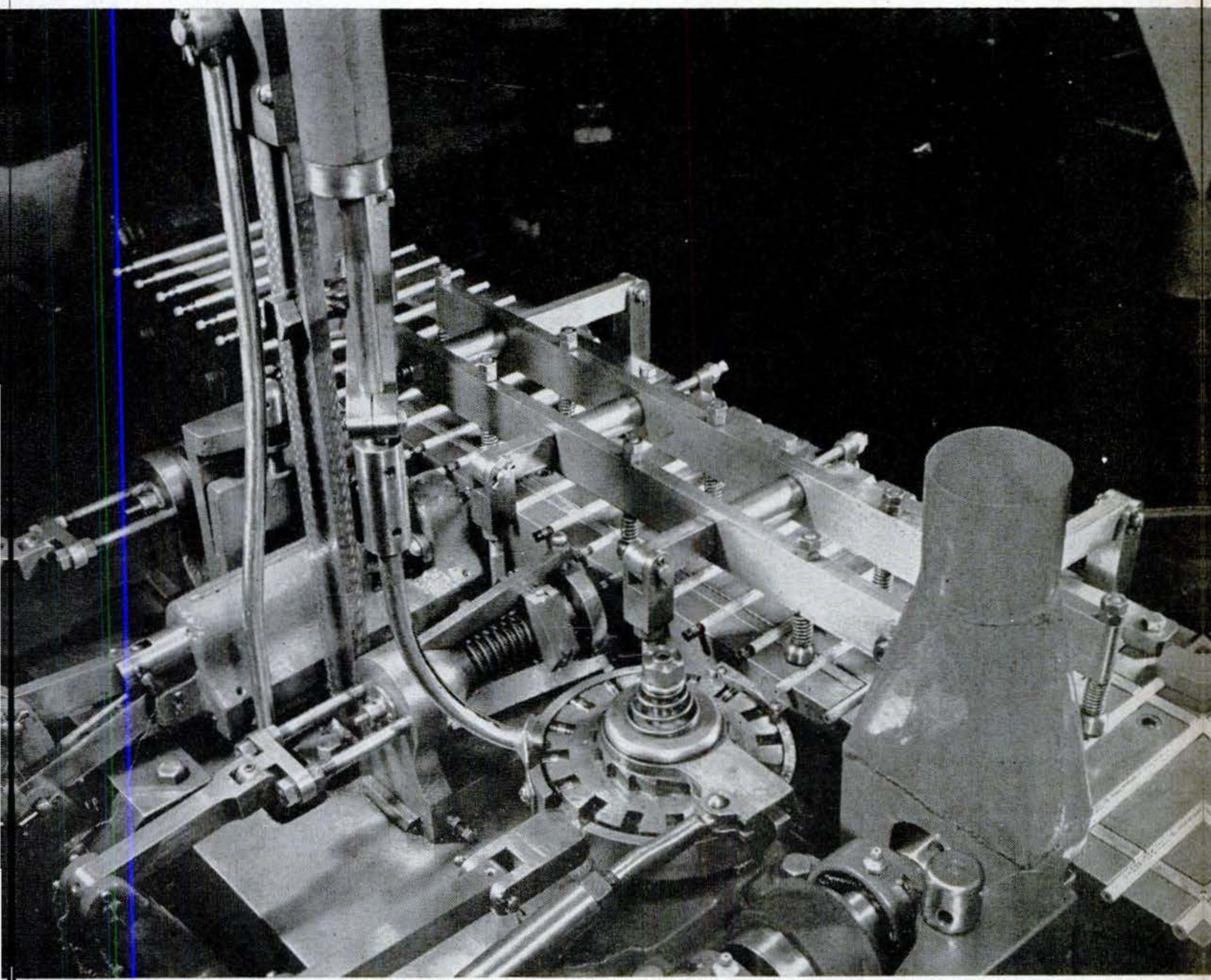


Firing takes four to eight hours, depending on the type of lead being made. Heat is maintained at 1,750° to 2,200° F. in gas furnace. This strengthens lead by fusing graphite and clay.



Wood sheaths for lead are made of slats half the finished thickness of pencils. These are grooved five to eight times, to a depth of half the diameter of the lead to be inserted.



To finish pencils, after they have been printed with trade-mark and type identification, this single machine performs five operations. It cuts a shoulder on one end of each pencil, presses on a metal cap or ferrule, clinches it, then inserts eraser and clinches that.

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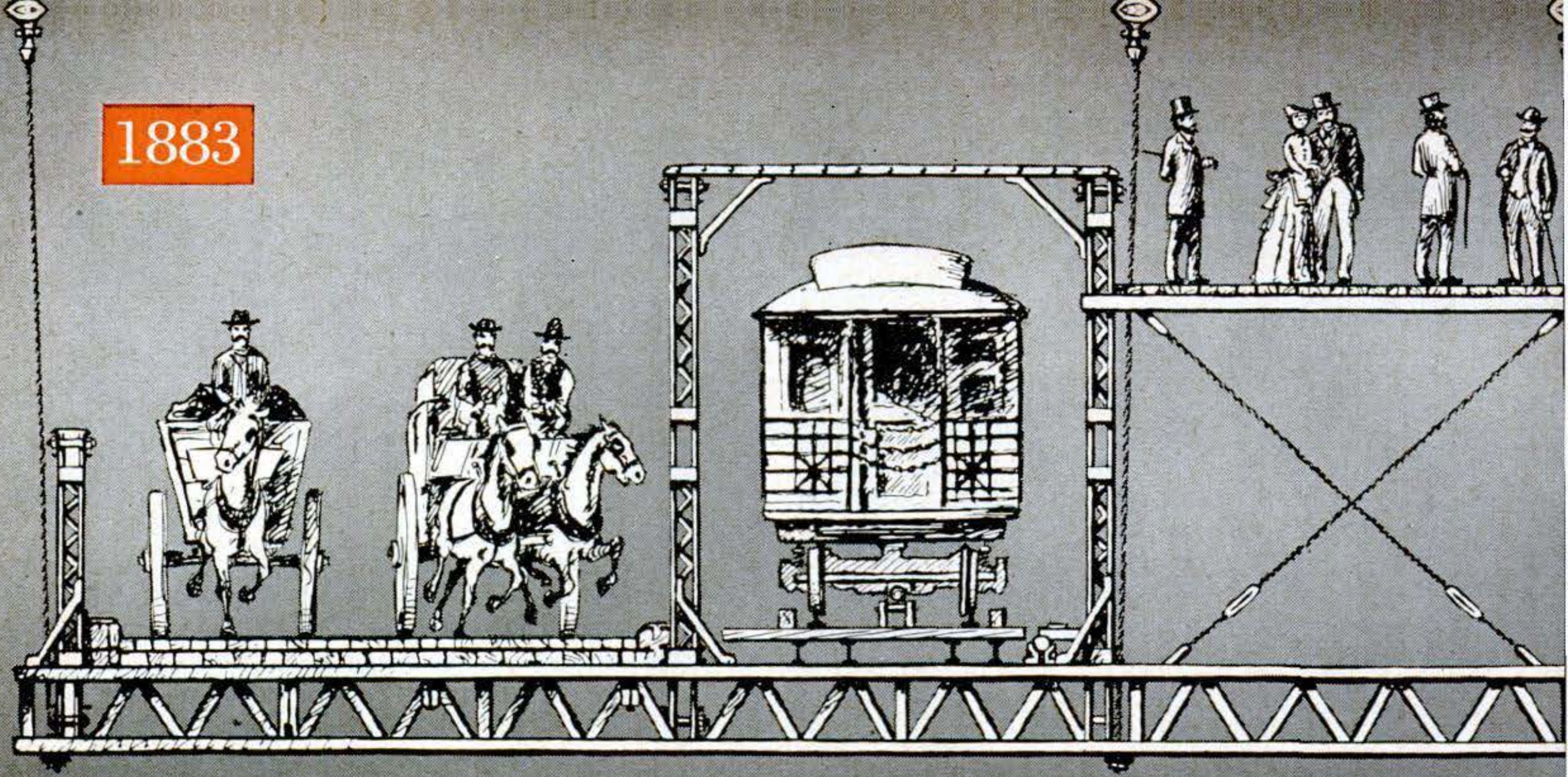
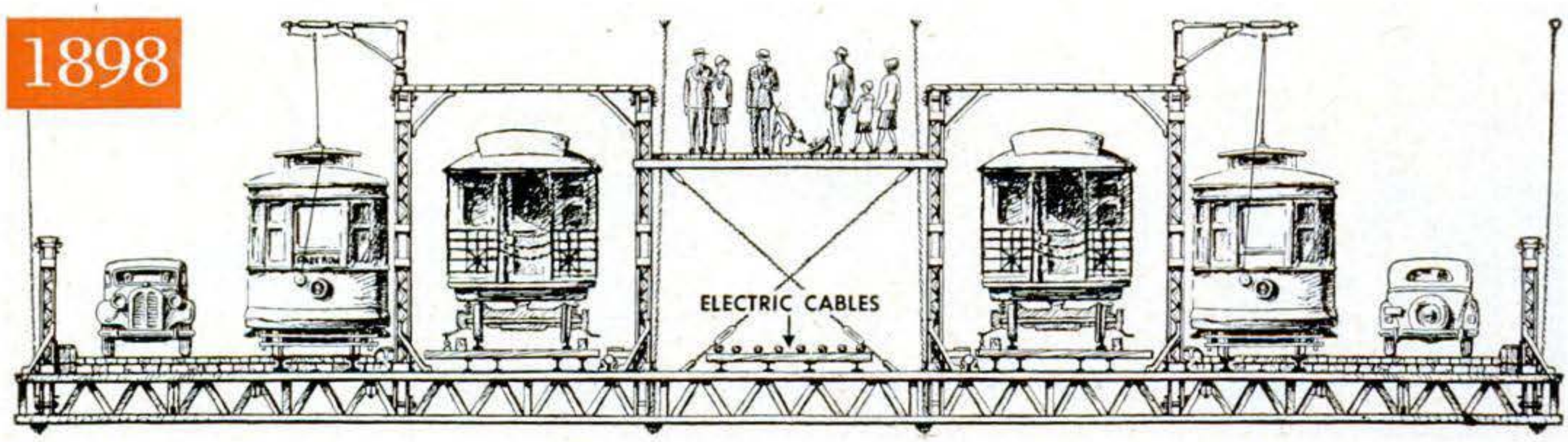
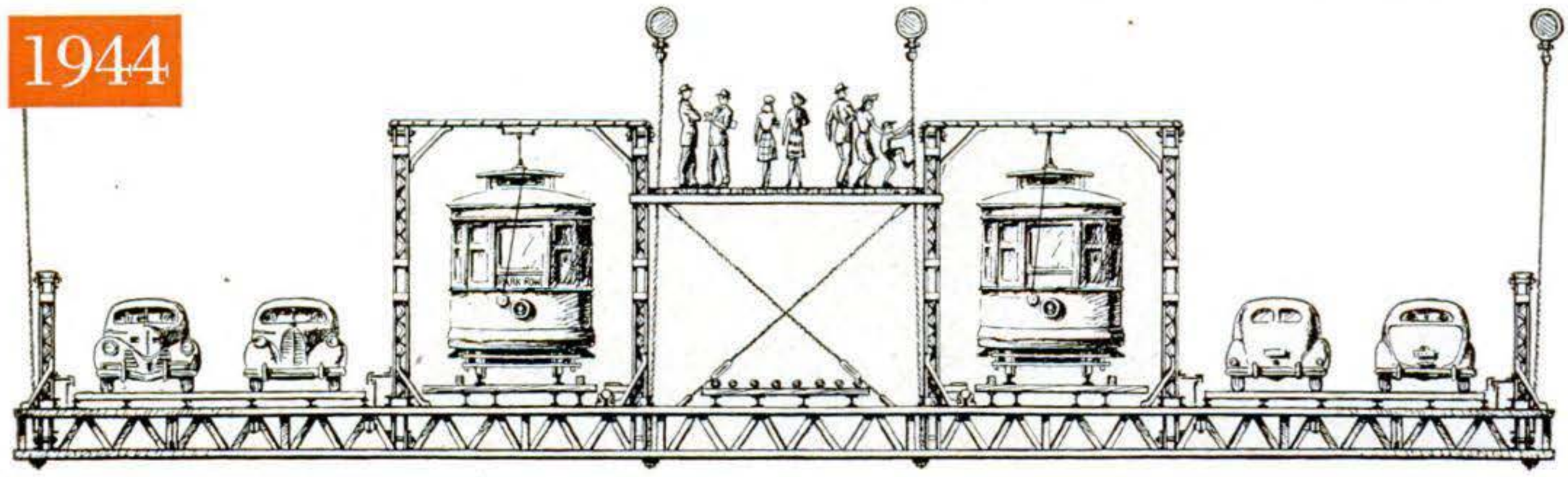


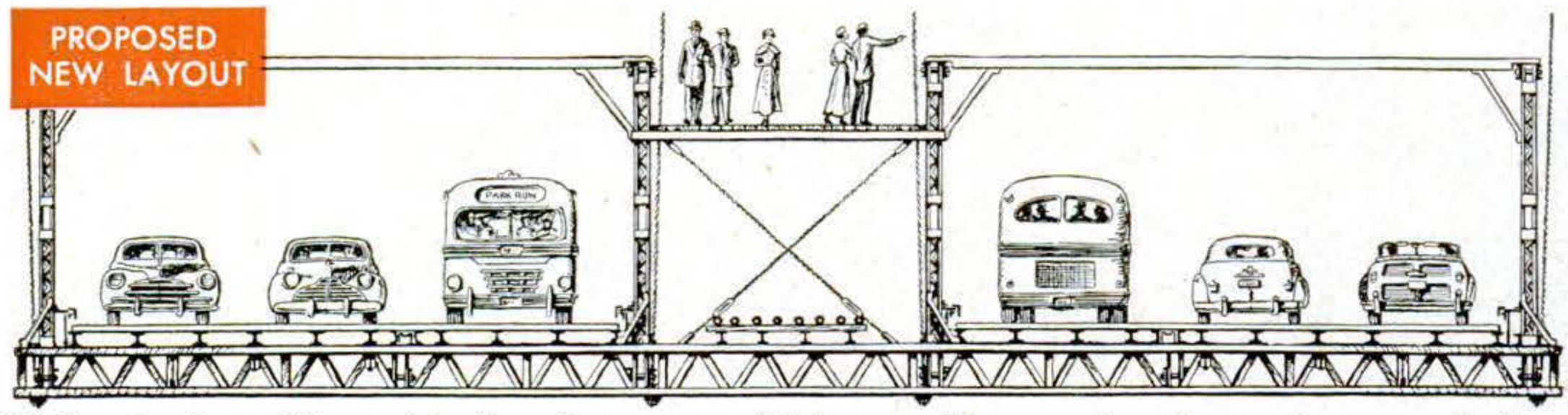
Cable cars and, in off hours, steam trains originally shared Brooklyn Bridge (photo inset)



Era of electrification brought "El" trains, and trolley tracks were laid in the roadways.



To give motor traffic more room, trolleys now use tracks of "El" lines, discontinued in 1944.



Modernization will provide three-lane motor highways. Note major change in truss design.

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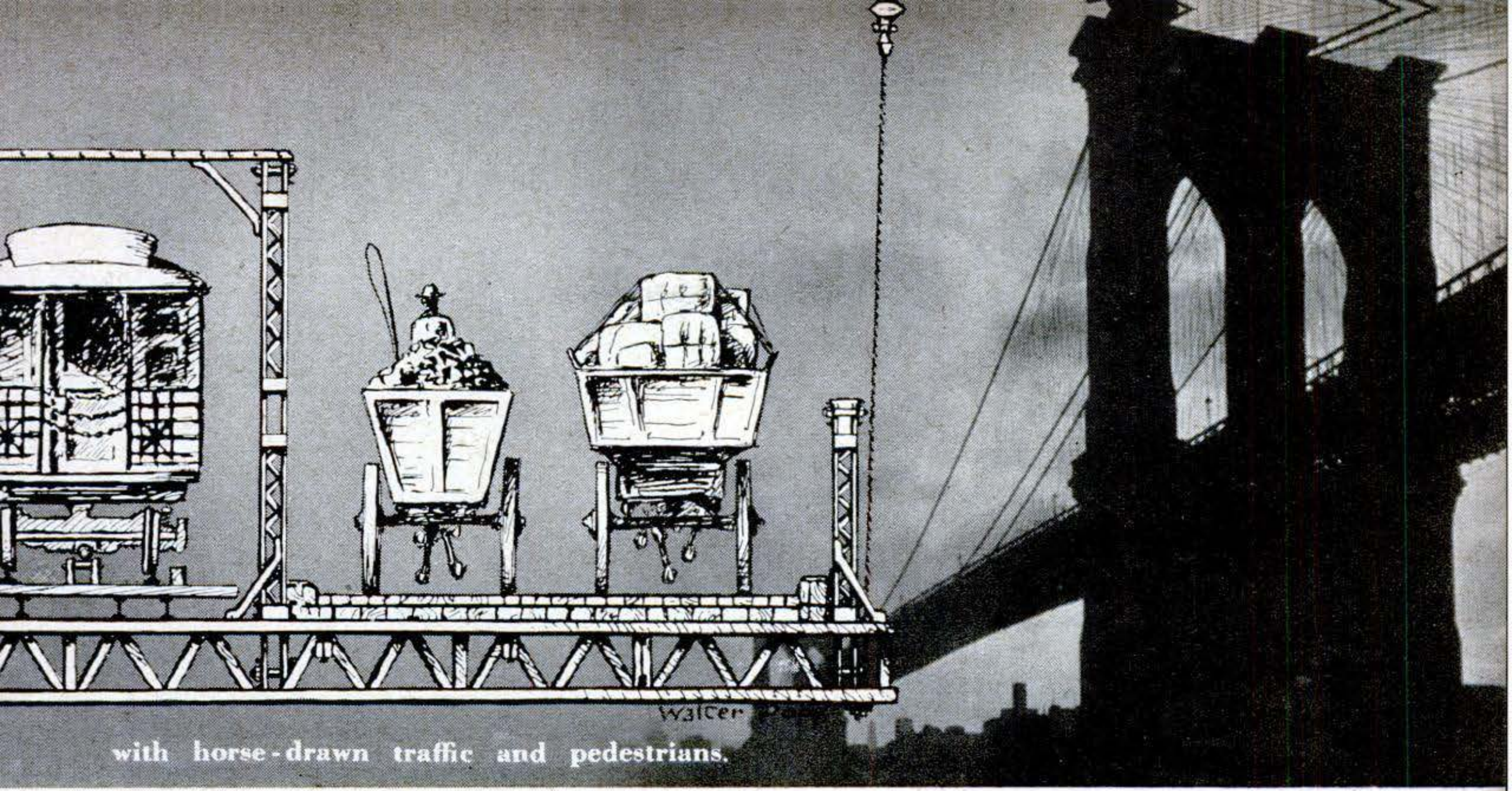

with horse-drawn traffic and pedestrians.

Bridge Spans Changing Eras

By W. Mack Angas

BROOKLYN BRIDGE, first of America's great suspension bridges, is about to be modernized.

Remodeling the vehicular deck of New York's historic East River span between downtown Manhattan and Brooklyn will permit a three-lane stream of automobiles and buses to flow in each direction on widened roadways flanking the raised pedestrian walkway. Motor vehicles will then take exclusive possession of a thoroughfare whose traffic has been a pageant of passing eras—horse-drawn carriages and carts, cable cars, steam trains, elevated trains, and trolleys.

Outwardly the appearance of picturesque Brooklyn Bridge, a landmark of New York harbor that predates the Statue of Liberty, will remain virtually unchanged. Structurally, revamping the 65-year-old span will be a major operation. It will follow plans prepared under the direction of Dr. Frederick H. Zurmuhlen, New York City's Commissioner of Public Works, by Dr. David B. Steinman, authority on suspension bridges.

Deep, strong stiffening trusses will be constructed at the outer edges of the roadways to replace present shallow ones. This will permit removal of deep stiffening trusses that now separate the roadways from trolley tracks. The trolleys will be banished, their tracks taken up, and the highway pavement extended over the space they now occupy. Approaches will be widened correspondingly and connected with express highways.

The work will start, at latest, as soon as completion of the new Brooklyn-Battery vehicular tunnel permits diverting bridge traffic to it. The project may be gotten under way even earlier by closing one roadway of the bridge at a time.

These alterations will adapt to mid-Twentieth Century needs a bridge whose construction—a 13-year task—began in the horse-and-buggy era of President Ulysses S. Grant. Press and public hailed the Brooklyn Bridge as the "Eighth Wonder of the World" when it was opened to traffic in 1883. Today the sturdy old span, designed by John A. Roebling and his son, Col. Washington Roebling, has proved a true wonder of planning ahead of their time. Illustrations on the opposite page show how, with only superficial changes, it has served the needs of succeeding generations. A detailed examination in 1943 showed its stone masonry towers, their foundations, and the four 15¾-inch steel suspension cables still in first-class condition. END

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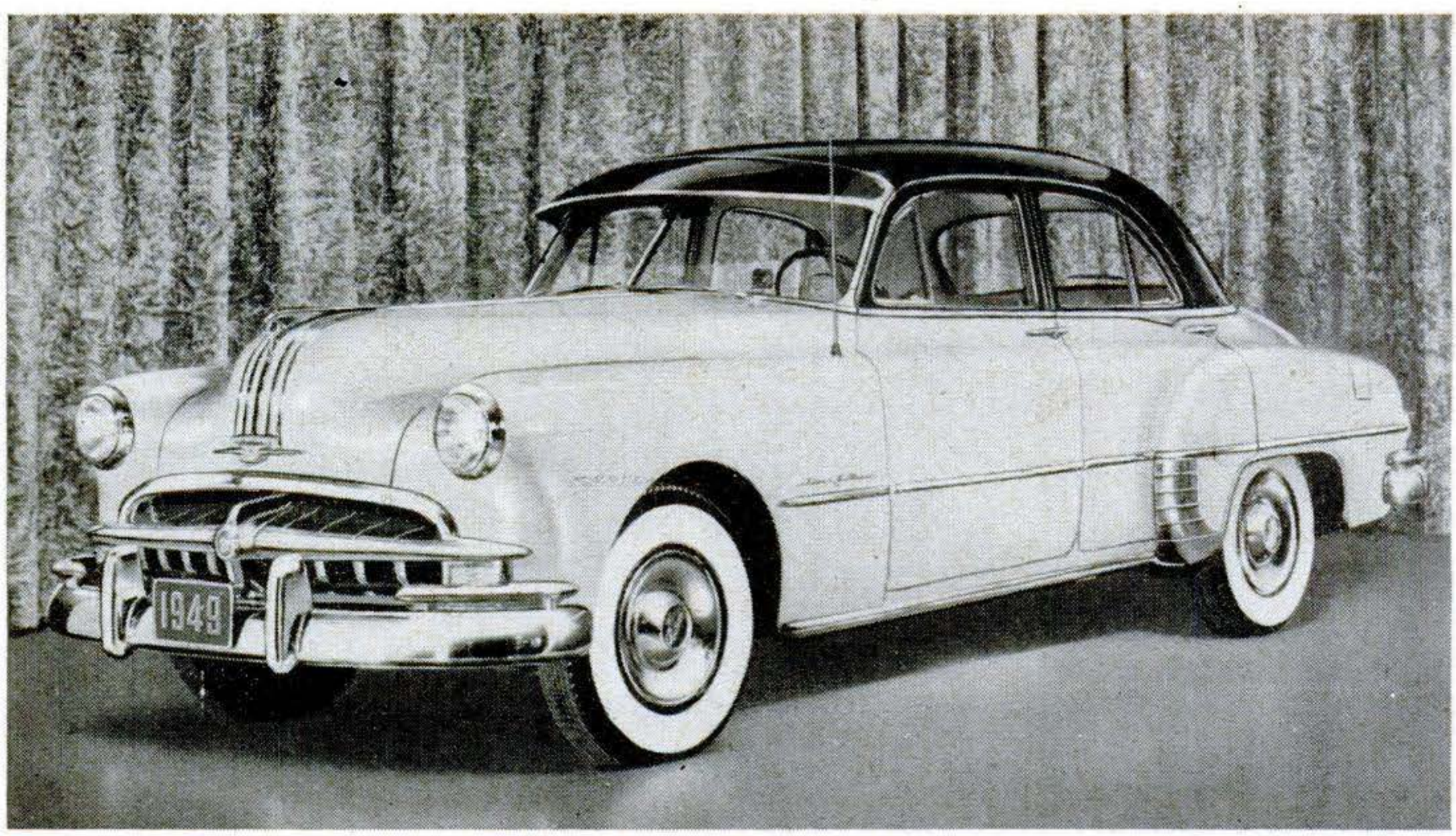
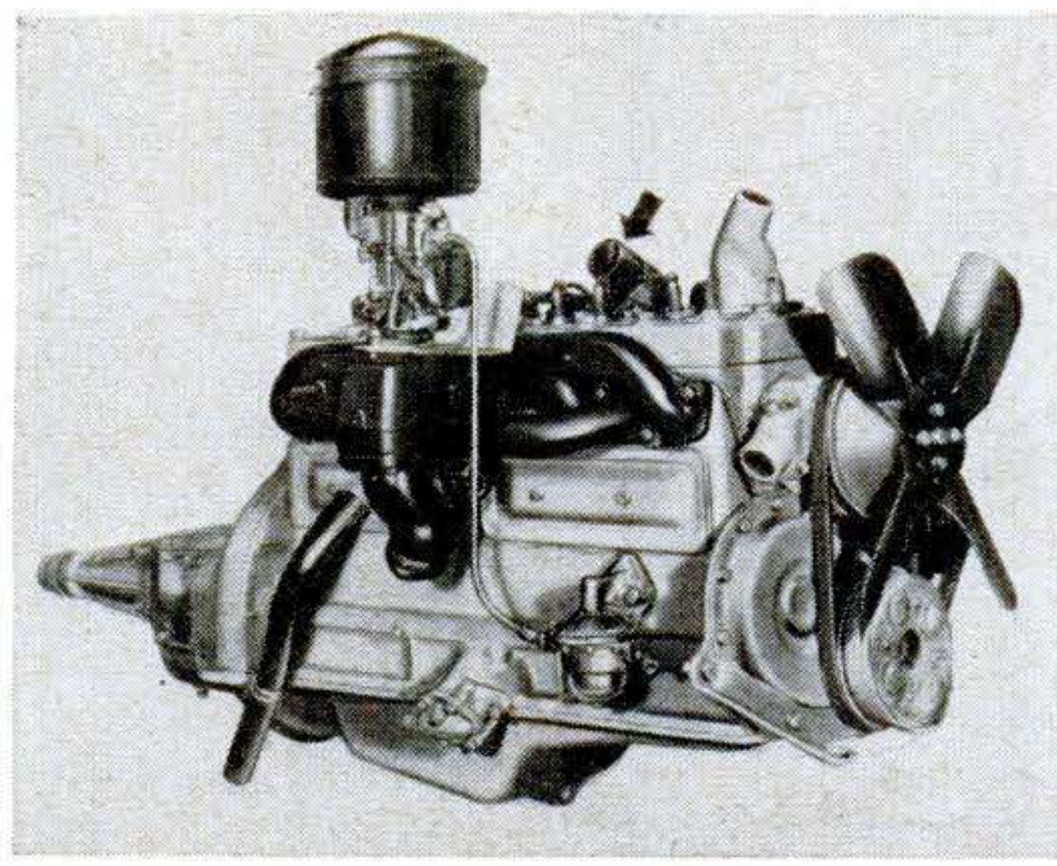


Snappy styling, better vision distinguish new Pontiac. Hood is lower, window posts thinner.

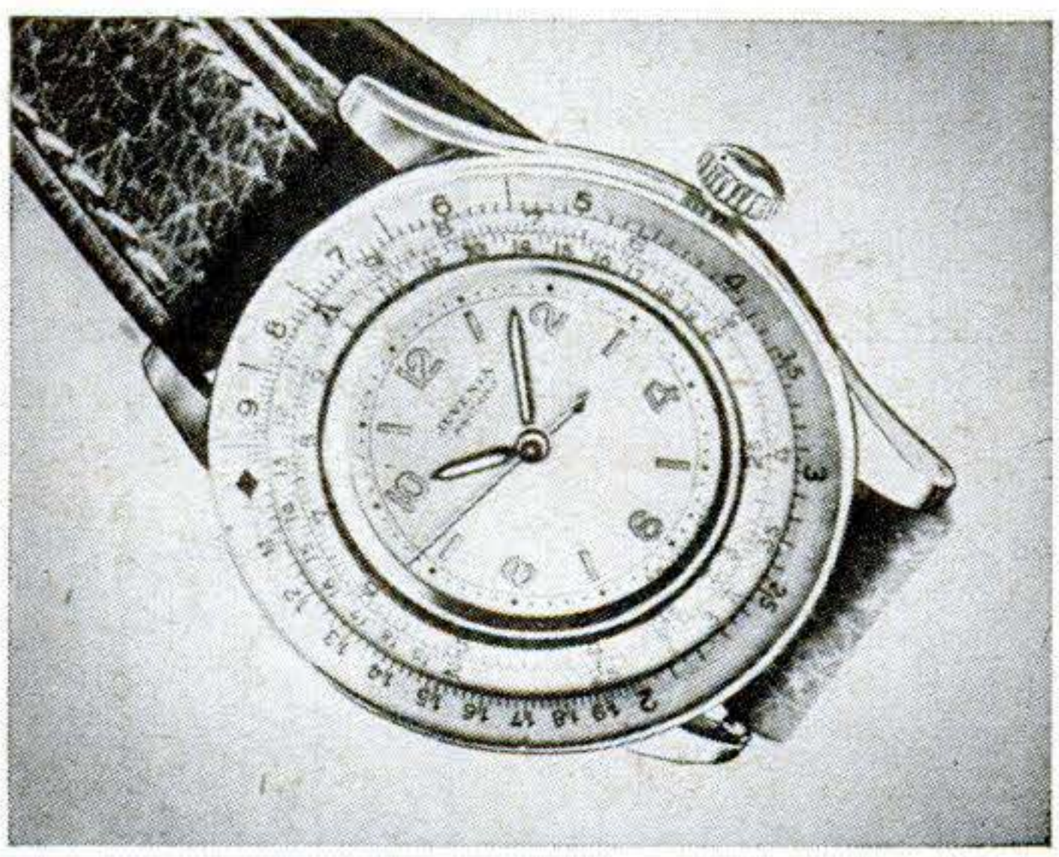
New Pontiac Is TV-Conscious, Too

THE new 1949 Pontiac aims to please television fans as well as car owners. Its ignition system, as shown at right, is specially designed to minimize TV interference.

Both of the new Pontiac series, the turtleback Chieftain® (above) and the slope-back Streamliner®, have 120-in. wheelbases. Front and rear seats are wider and farther forward for greater riding comfort. The steering column is two inches farther to the left, giving the driver more elbow room. A plastic lens magnifies the speedometer numerals to twice their size. Front doors are six inches wider, rear doors nine inches wider. Window area is increased 38 percent.



Placing spark coil atop engine (arrow) shortens high-voltage leads 75%, minimizing chances of TV interference. Lower-pitch fan blades cut high-speed noise. Engine can be six or eight.



Slide Rule Rims Wrist Watch

THIS new Swiss calculating wrist watch, the Juvenia Arithmo®, is designed so you can use its slide rule without craning your neck. All numbers are read right side up.

Two fixed inner scales, for multiplication and division, and a movable outer scale circle the dial. To solve a problem, the first figure, on the outer scale, is lined up at 12 o'clock with a transparent pointer. Scale and pointer are then moved together counterclockwise until the pointer lines up with the second figure on one of the inner scales. The answer is then found at 12 o'clock.

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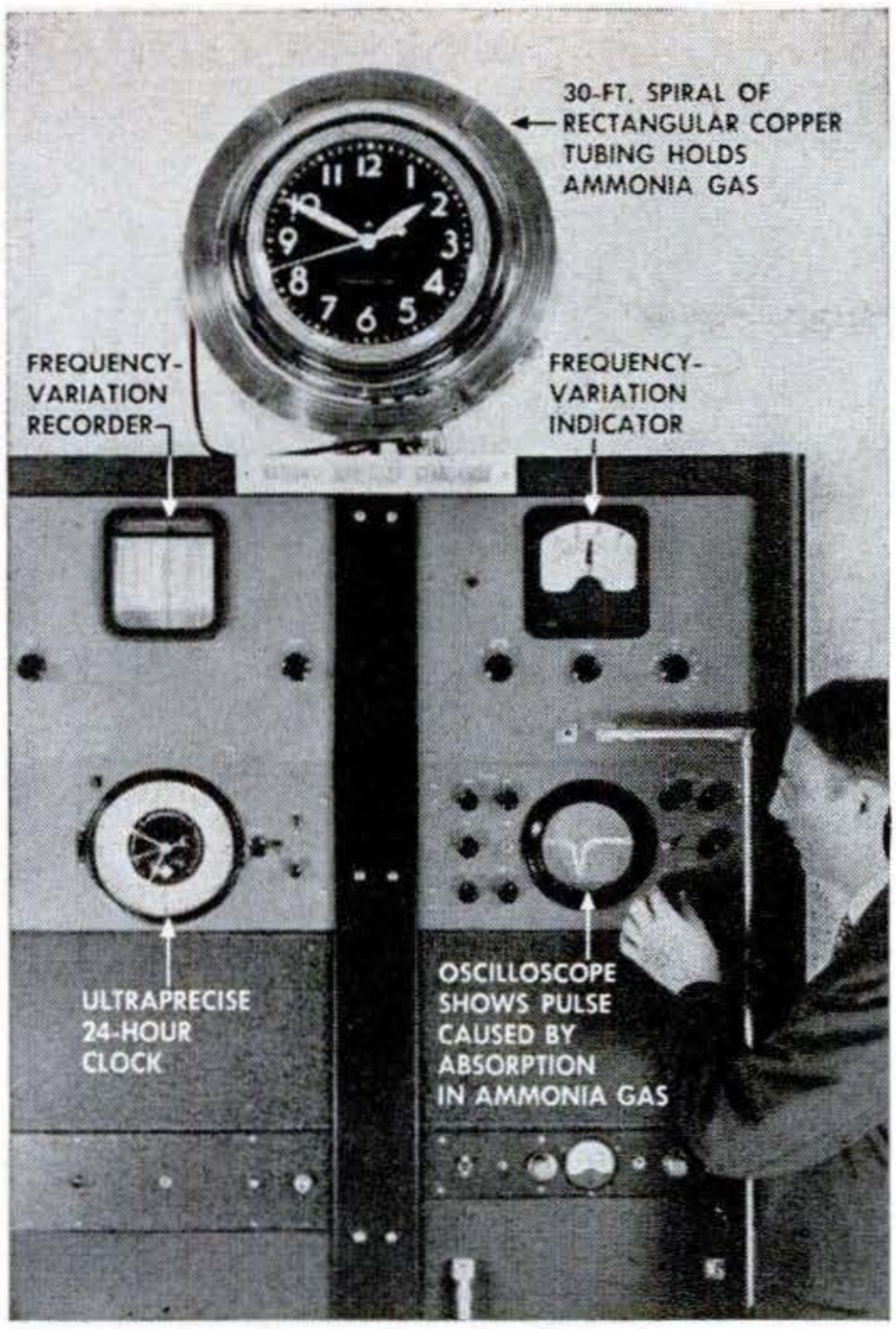
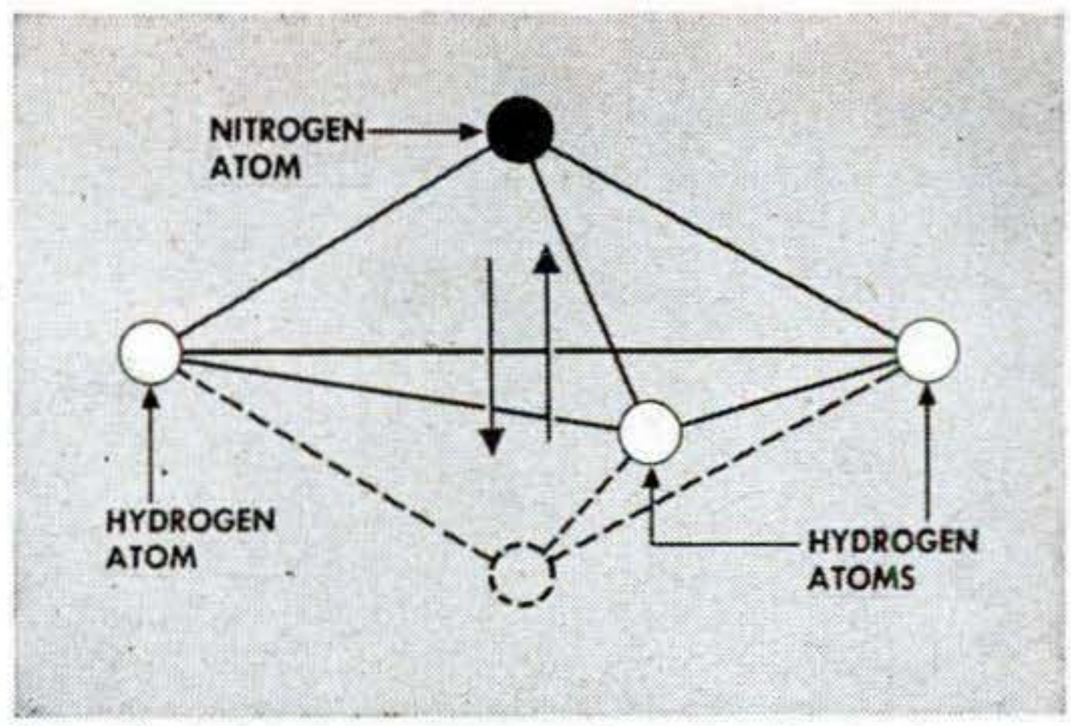
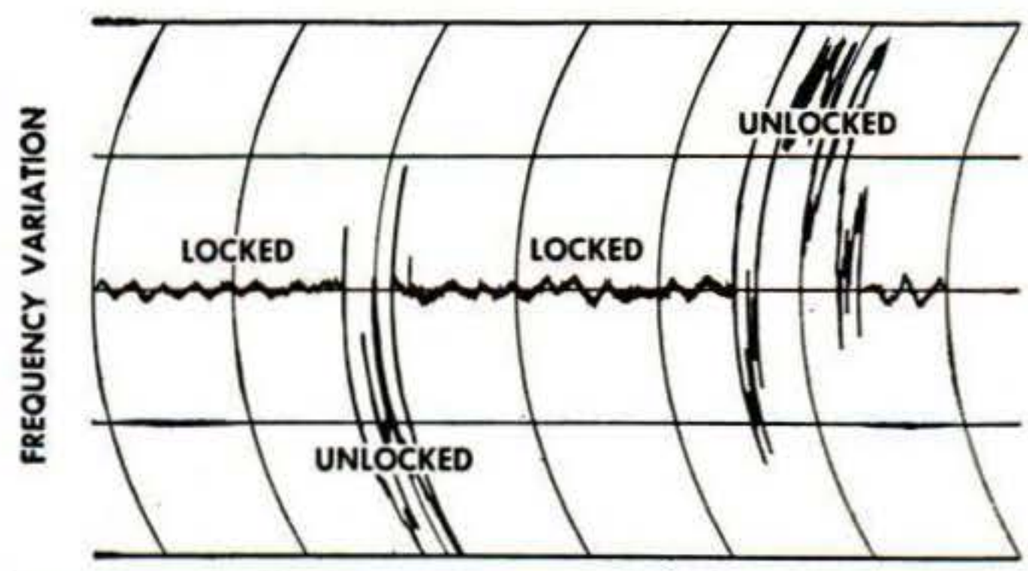


Steady vibrations of molecules of ammonia, in tubing wound around clock face, continuously correct oscillations of quartz crystal that controls speed of synchronous motor driving clock.



Sketch of ammonia molecule shows how it ticks time. Nitrogen atom jumps up and down, turning pyramid-shaped molecule inside out, when fed energy at frequency of 23,870.4 mc.



Frequency-deviation record of six-hour test run shows narrow variation in clock's speed when paced by ammonia molecule and wider deviations when running without that control.

Atoms Run New Superclock

AMMONIA—the stuff housewives use to clean windows—now keeps time. It is used in a new kind of clock, the first ever to make time-keeping independent of astronomical observations. Developed by the National Bureau of Standards, this clock is expected to help astronomers, navigators, and radio engineers.

The rotation of the earth has been the time standard for centuries. But the earth doesn't always turn at the same speed.

The new clock uses the ammonia molecule's vibrations as its standard. It compares those vibrations to the ticks of a quartz crystal, and adjusts the crystal so that it always ticks with the ammonia molecule. The crystal, in turn, controls an electric clock by changing DC to AC, whose exactly regulated cycles run the clock with extreme accuracy.

All molecules and atoms vibrate, like ammonia, at some particular frequency. Each gets the energy for its vibrations by absorbing energy of a given frequency. In the case of the ammonia molecule, the vibration and absorption occur when energy is fed in at 23,870.4 megacycles.

Microwaves generated by the quartz crystal enter one end of a 30-ft. tube filled with ammonia gas. As long as the microwaves are exactly at 23,870.4 megacycles, most of them are absorbed by the gas. When the crystal gets off the beat, however, more microwaves get through the ammonia to a detector at the other end of the tube. The detector then signals an electronic frequency discriminator, which brings the crystal back into tune with the ammonia.

Yet even ammonia has its limitations. The present atomic clock is accurate to about one second in eight months. By using other atoms or molecules, still higher precision—as great as one second in 300 years—is expected.

This exact control of wave frequencies may also permit squeezing more TV channels into the crowded radio spectrum, since each could fit into a narrower band. END

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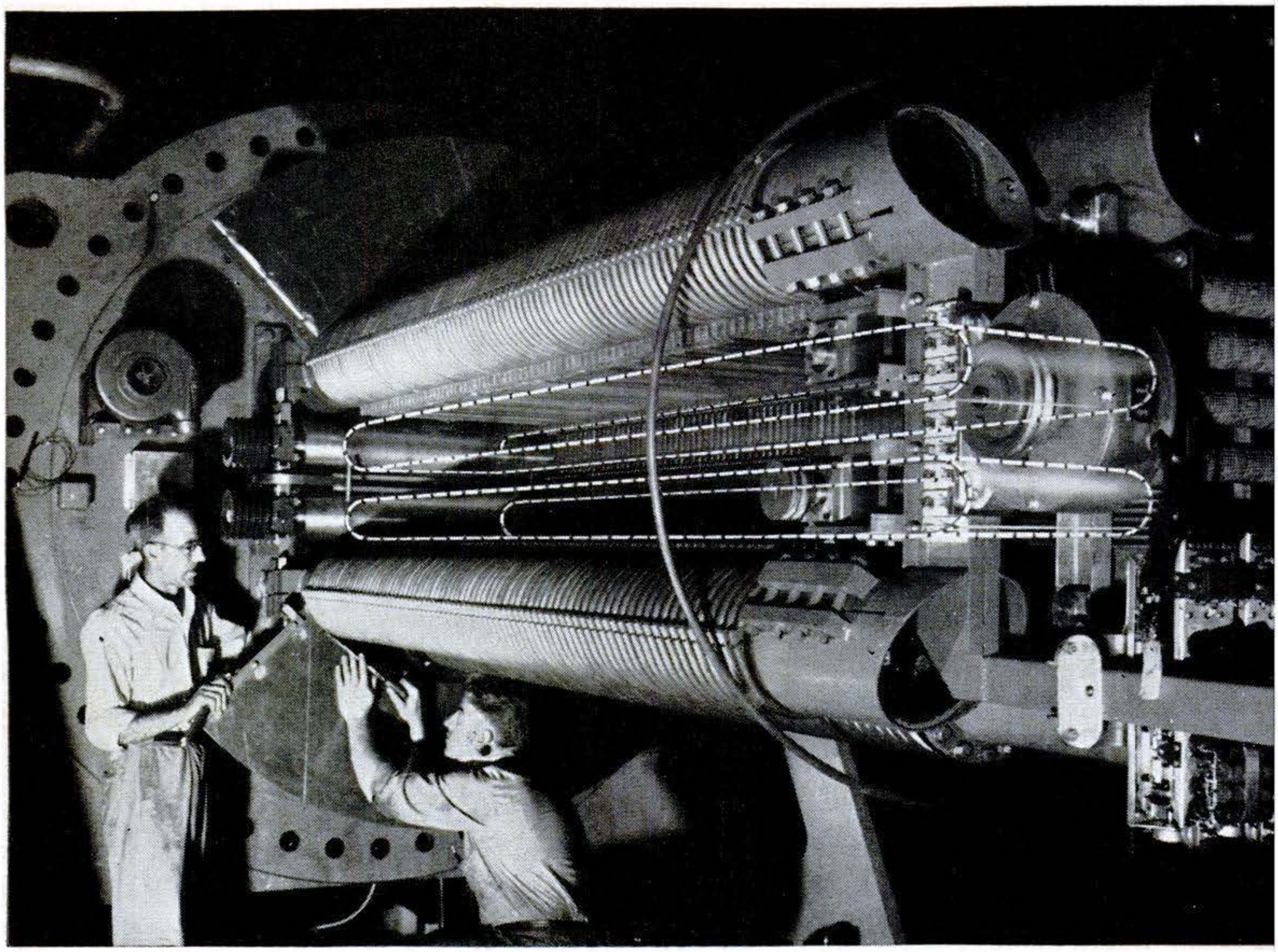

First of two multimillion-volt Van de Graaff generators for Brookhaven National Laboratory is assembled at General Electric plant, Schenectady. Dotted lines represent motor-driven belts that will convey electrical charges to build up man-made lightning of 3,500,000 volts.

"Assembly Lines" Built For Lightning Factory

PILING up electrical charges by means of whirling conveyer belts, a pair of multimillion-volt Van de Graaff generators will assemble artificial thunderbolts in a modern lightning factory at Brookhaven National Laboratory, Upton, N. Y.

The larger generator, a 4,000,000-volt machine still in the design stage, will have the more spectacular role. A potent atom-smasher in its own right, it will feed one of the mightiest on earth—Brookhaven's projected 3,000,000,000-electron-volt "cosmotron." (This new name has been chosen for the monster, doughnut-shaped proton synchrotron, 60 ft. in diameter, described in POPULAR SCIENCE last year: Jan. '48, p. 113; July, '48, p. 270.) The Van de Graaff generator will deliver a beam of protons to the giant atom-smasher for further acceleration.

Meanwhile, Brookhaven will place in service a 3,500,000-volt Van de Graaff generator in an atom-smashing laboratory of its own. Experimenters will operate it by remote control, shielded from dangerous radiation by two-foot-thick concrete walls, to produce neutron beams, study transmutation of elements, and develop such techniques as gamma-ray spectroscopy. This generator will also be used by the research workers to perfect the design of the larger one and the method of injecting its beam into the cosmotron.

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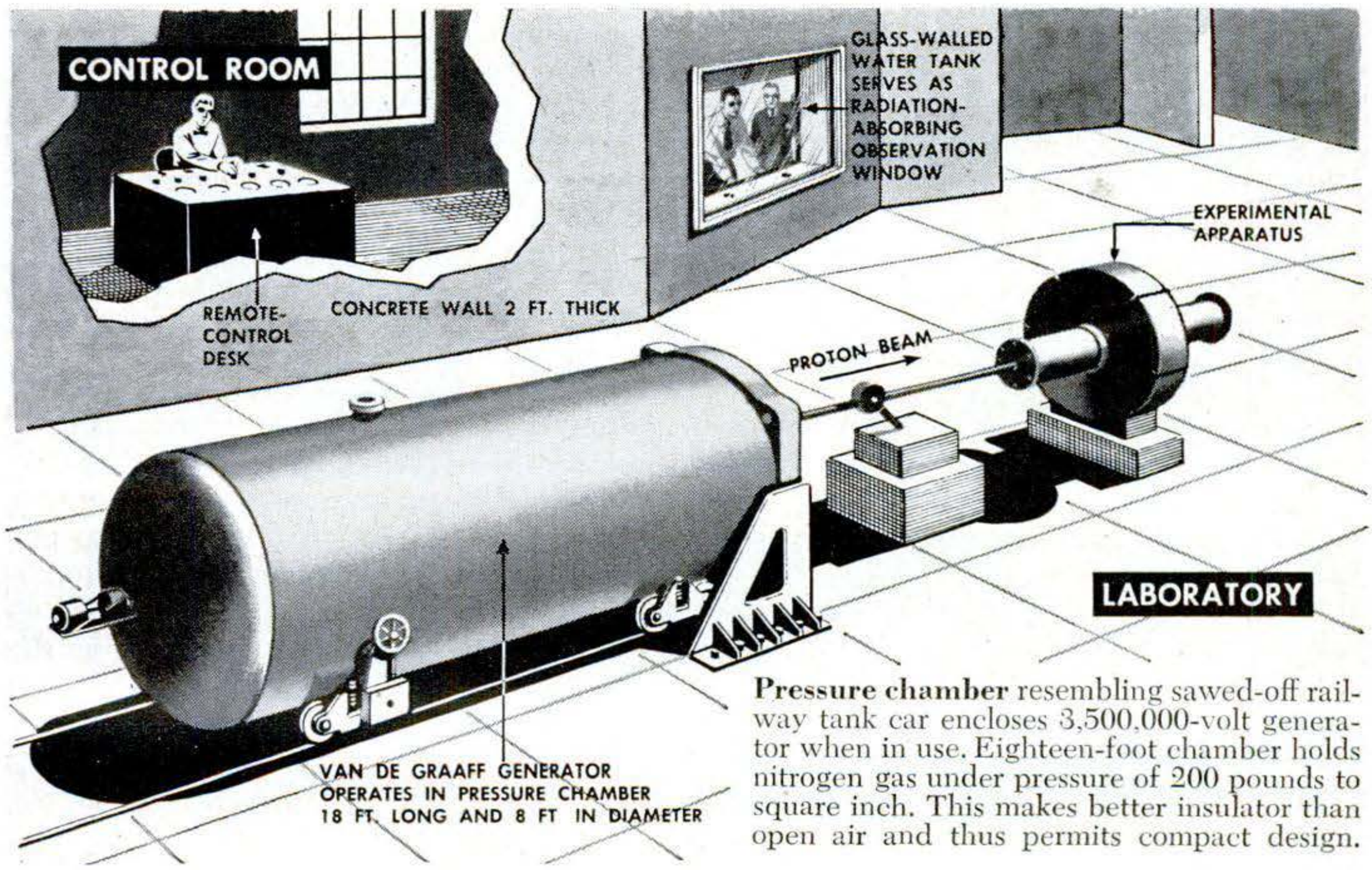
Built-in accelerating tube will harness power of 3,500,000-volt generator to produce a beam of speeding protons, or positively charged hydrogen particles, for experimenters to wield. Panel below tube transmits performance data to dials of remote-control desk used by operator.



Pressure chamber resembling sawed-off railway tank car encloses 3,500,000-volt generator when in use. Eighteen-foot chamber holds nitrogen gas under pressure of 200 pounds to square inch. This makes better insulator than open air and thus permits compact design.

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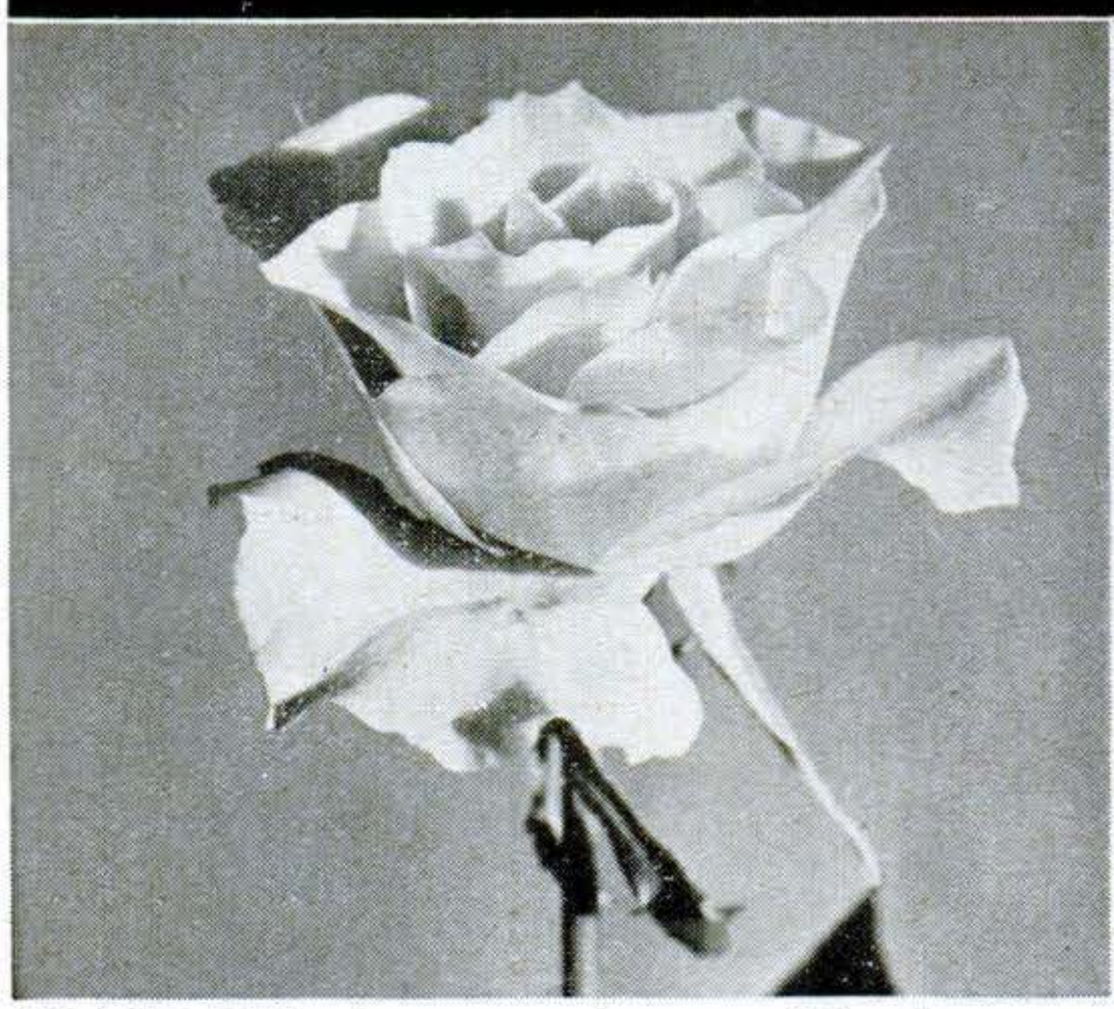
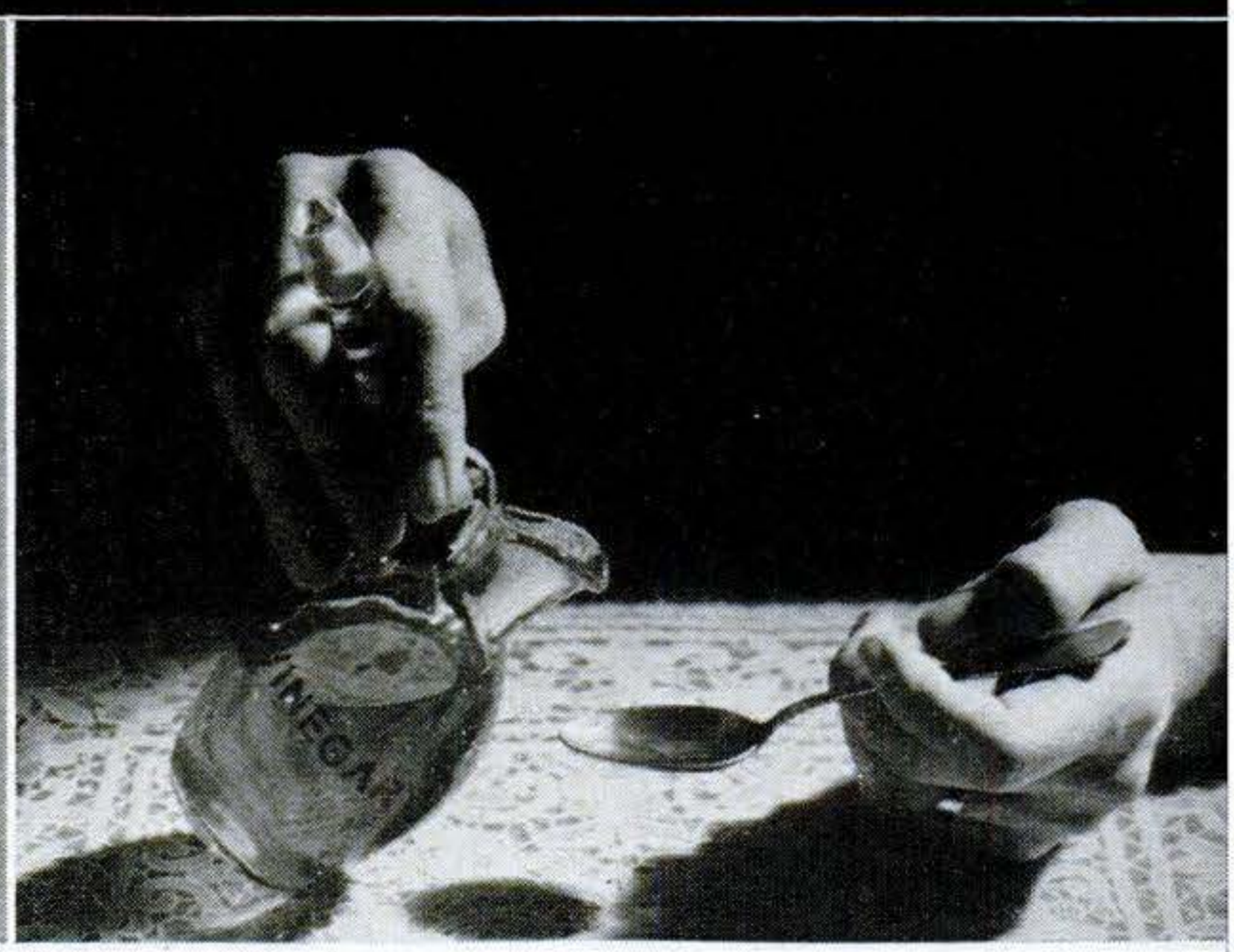
EVERY KNOWN SMELL IS COMPOSED



FRAGRANT odor, most pleasing of fundamental ones, predominates in scent of rose, above, other flowers and perfumes made from them, cedar wood, spices like cinnamon and nutmeg.



ACID smell, the second in human preference, stands out especially in odors of vinegar and acetic acid. Fruity odor of lemons, oranges, and grapefruit is largely fragrant-plus-acid.

What Is a Stink?

Science has found an ingenious way to define odors and offers a new explanation of how you smell them.

By Alden P. Armagnac

YOU can tell a rose from a skunk with your eyes shut. But just *how* does the "stink" of a pig-in-the-pen differ from ham-in-the-pan that "smells good"? Why do things smell the way they do, anyway?

Salesmen as well as scientists would like to know the answers. The appetizing odor of your breakfast bacon, the fragrant aroma of a cigarette, are Big Business. Pleasing odors, artificially imparted, help to sell soaps and cosmetics, wallets and handbags of artificial leather, raincoats, linoleum, fabric for suits and dresses, paint, paper, and printer's ink.

Yet the art of creating and using odors has so far to go to become an exact science that even its vocabulary reflects its groping.

How would you describe a smell? You could take almost any adjective in the English language—"pungent," "aromatic," "flowery," or "spicy," to mention a few—and apply it equally well to any one of hundreds of different odors.

Colors of the spectrum can be readily identified by their wave length, the pitch of a musical tone by its frequency—but meat packers and perfumers have been able to describe individual odors only as "like roses," or like camphor, or new-cut hay, as the case might be.

Only recently has an ingenious way been perfected to name and define any one of the 4,000 to 8,000 different odors that your nose can distinguish.

Called the Crocker-Henderson system after its originators, E. C. Crocker and L. F. Henderson, it applies their discovery that all smells can be regarded as blends of just four "primary" or fundamental odors.

These four basic smells are called "fragrant," "acid," "burnt," and "caprylic," the last meaning goatlike. The fragrant component predominates in heliotrope and jasmine; the acid, in vinegar and in its

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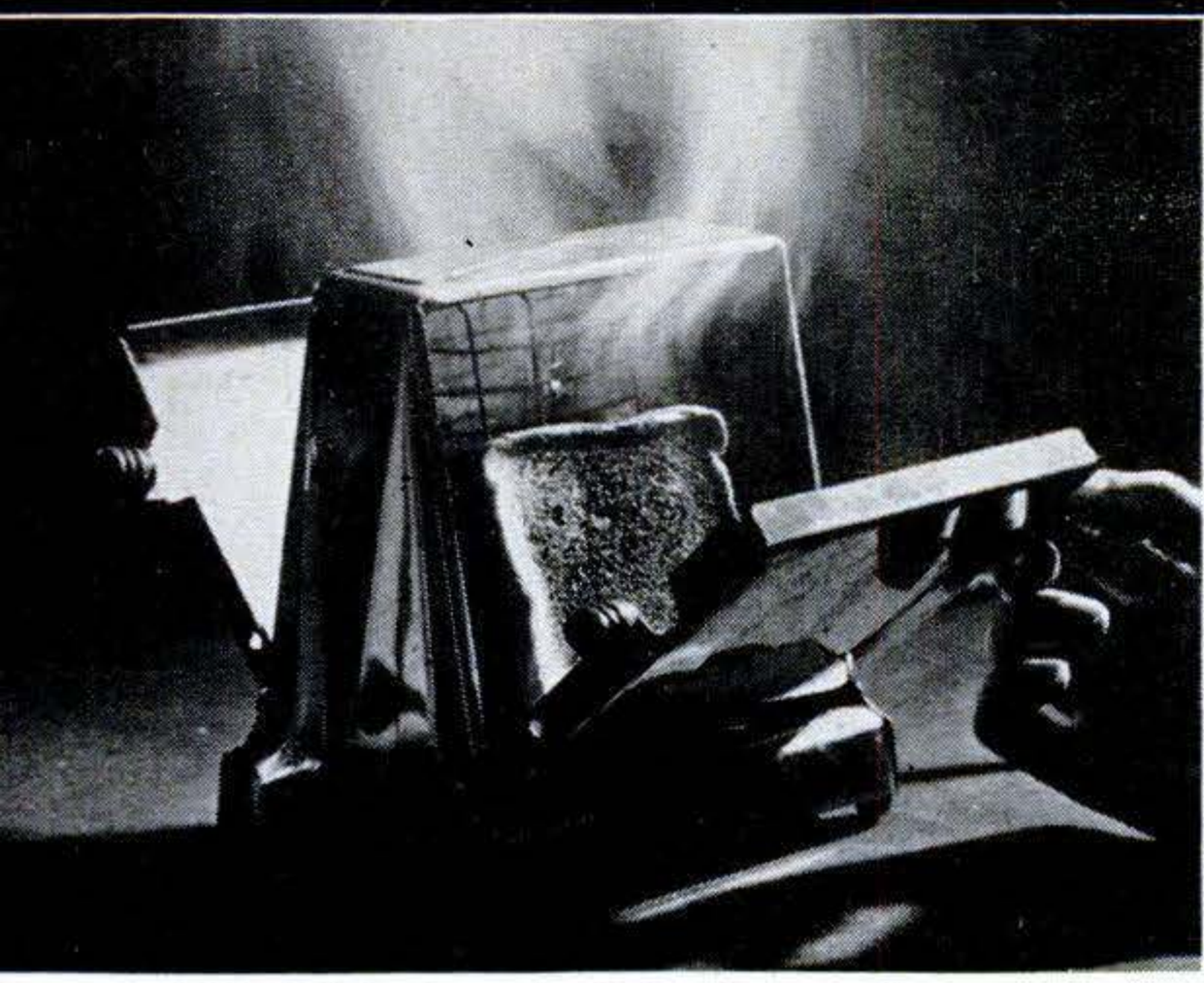
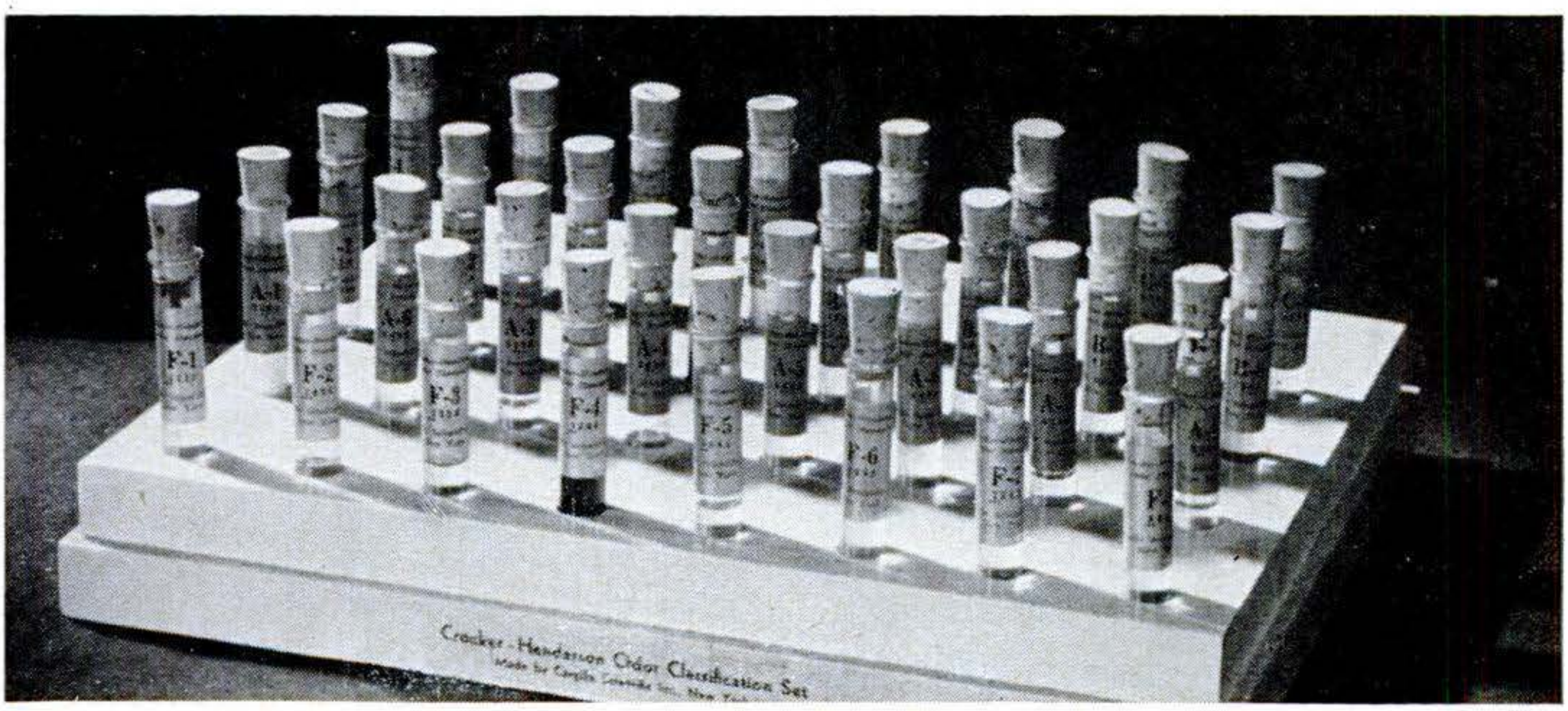
OF THESE FOUR BASIC ELEMENTS

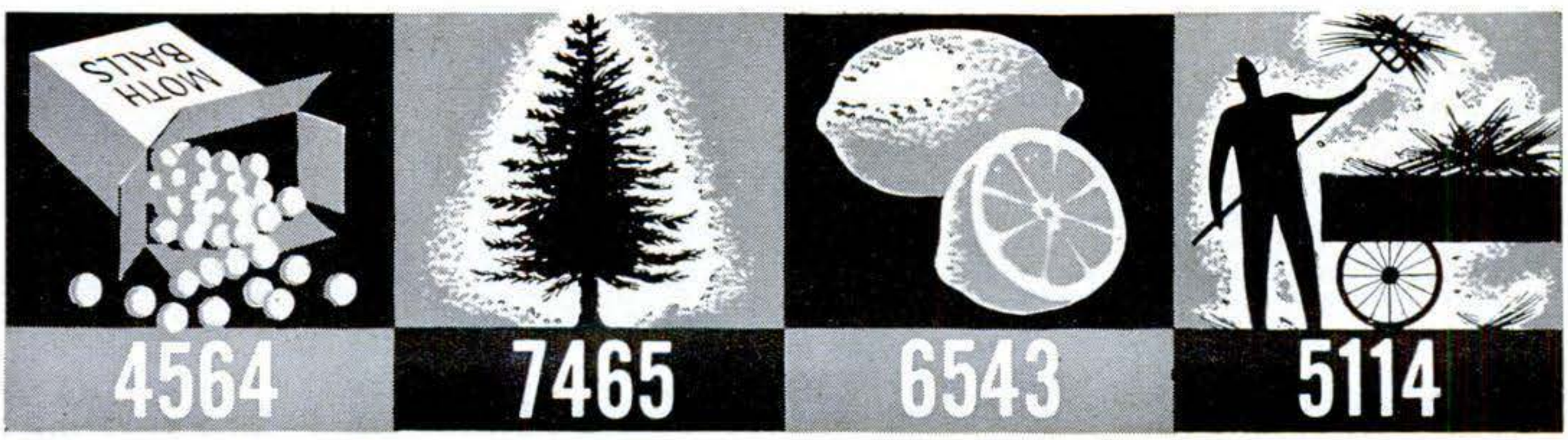


BURNT odor, third fundamental one, may not appeal to you when you scorch the toast, but is an important ingredient of oriental perfumes. It's also prominent in moth balls and tar.

CAPRYLIC means goatlike, but this basic scent characterizes all animal odors—exemplified above by Stinky the Skunk. Name any foul smell and you'll find its caprylic ingredient strong.



Defining a stink or a perfume exactly is made easy by this "odor-classification set" recently placed on the market. Each row of numbered vials contains samples of substances arranged, from left to right, in order of increasing intensity of one of their four fundamental odors. By matching a scent against them, user obtains a four-digit number that precisely describes it.



Typical numbers obtained when odors are matched with vials of testing set are illustrated above for moth balls (napthalene), spruce tree, lemon, and fresh-cut hay or the substance called coumarin, its equivalent in perfumery. Any one of the 4,000 to 8,000 odors that your nose can distinguish may be identified, beyond all uncertainty, by a number between 0000 and 8888.

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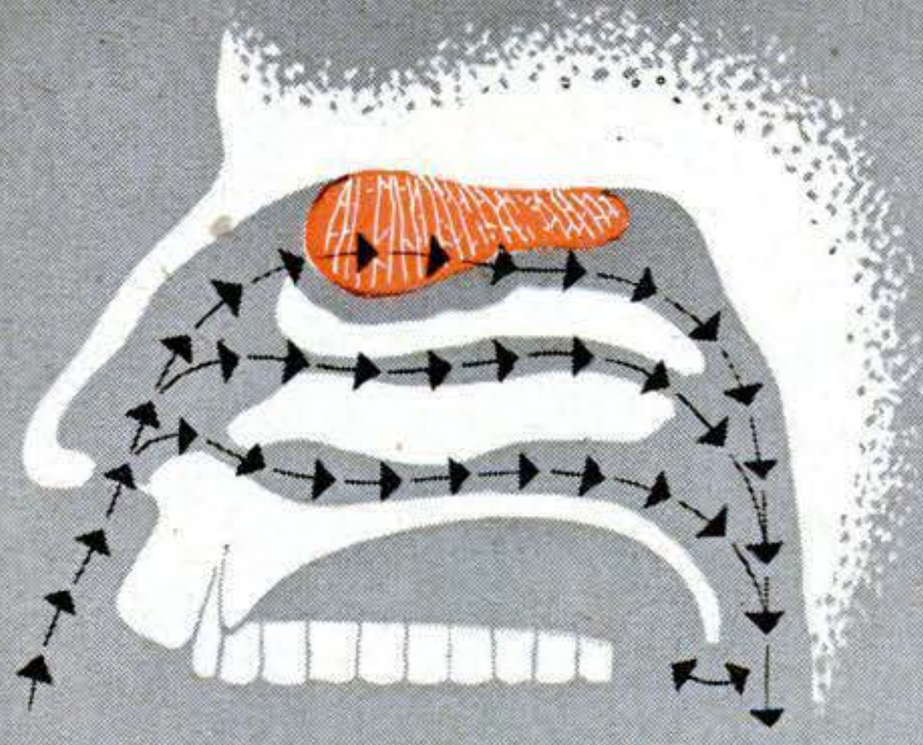
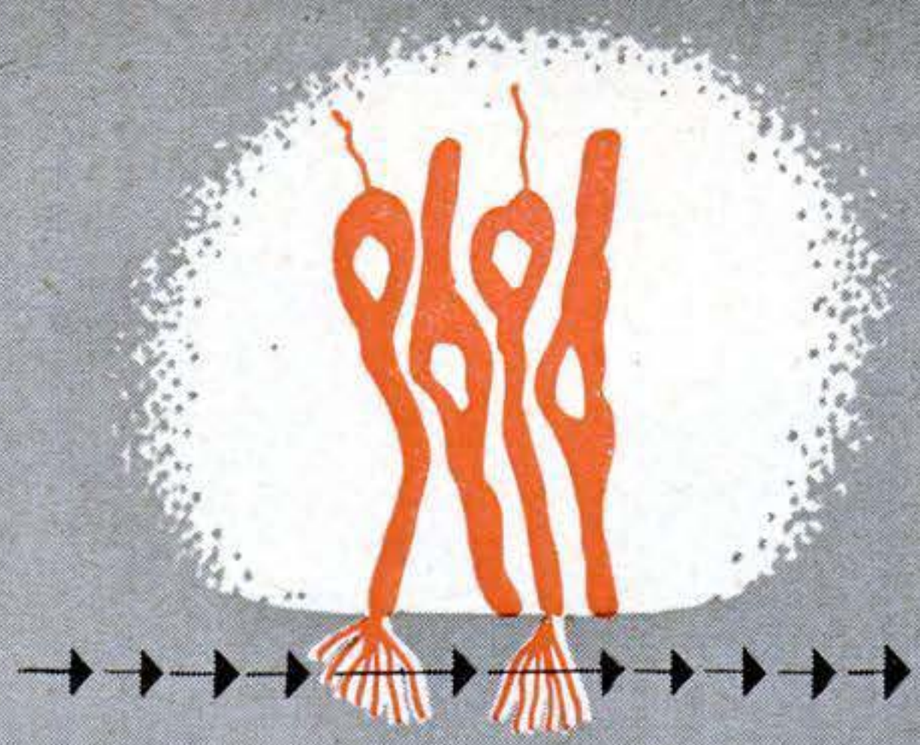
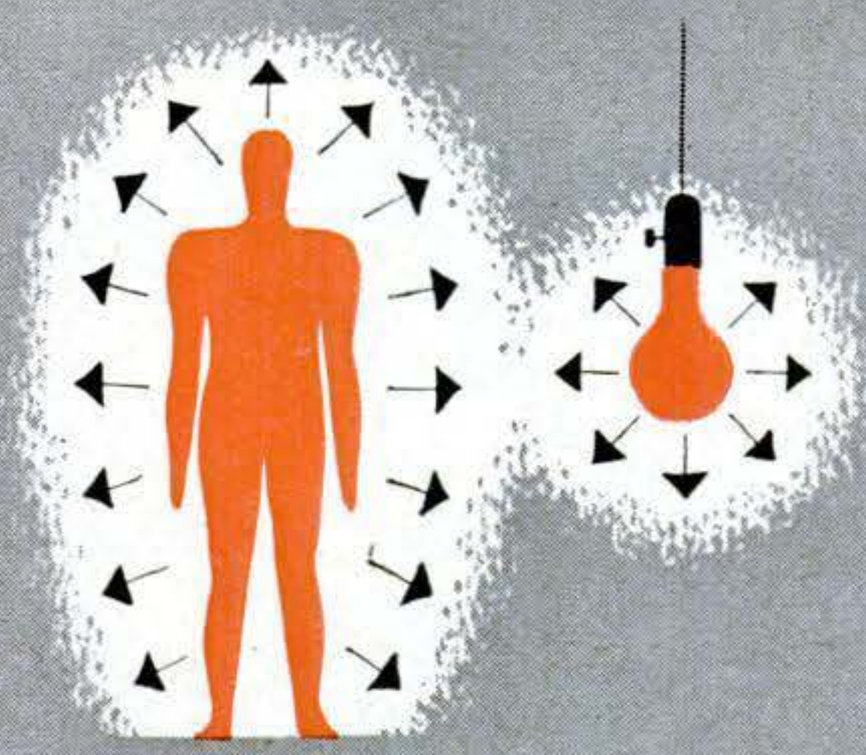


Seat of your sense of smell, the olfactory cleft (shown in color) lies at roof of nasal cavity. It detects odors in air passing inward from nostrils. or upward and outward from mouth.



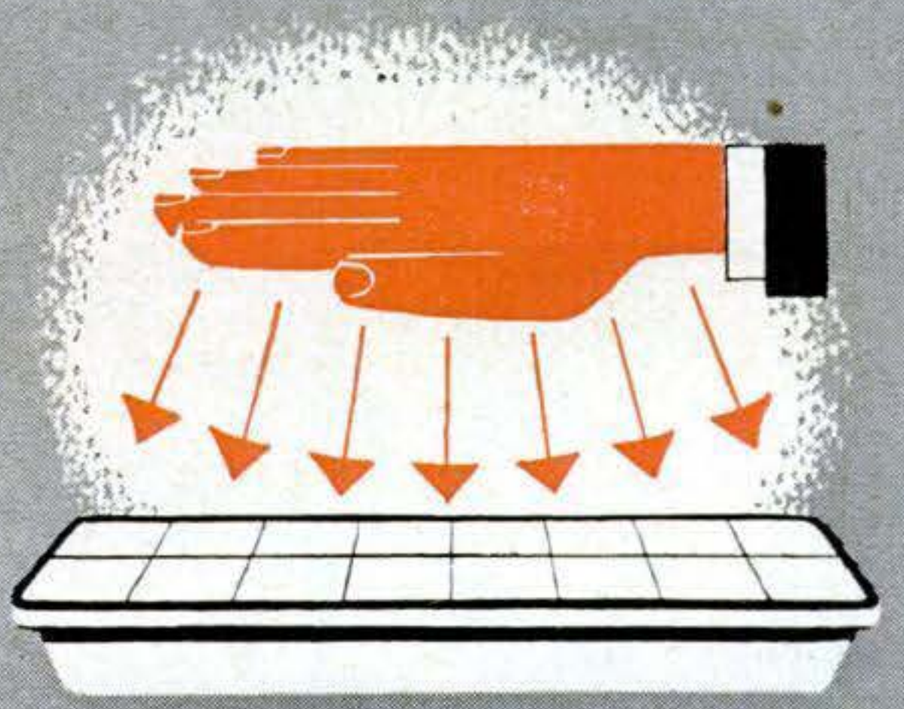
Smell-detecting cells of olfactory cleft, shown highly magnified, have tufts of microscopic hairs projecting into air passage. Mystery of how they work may be solved by new theory below.

HOW NEW "RADAR" THEORY EXPLAINS SENSE OF SMELL



1. A man of average size constantly emits about the same amount of heat as a 100-watt electric lamp bulb—much of it in the form of radiant heat or invisible infrared radiation.

3. Loss of similar infrared rays from olfactory region of nose, new theory holds, gives sensation of odor instead of chill. Odor-bearing substances are known to absorb infrared.



2. Place your hand above an ice-cube tray and you can feel its coldness without touching it, due to loss of infrared radiation from your warm hand that is absorbed by the colder tray.

4. So olfactory cells act like miniature radar stations, and you smell a substance when airborne particles come within range of their rays, which are absorbed instead of being bounced back like radar waves. Cells emit various wave lengths, different substances absorb different ones — and smell different.

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natural constituent, acetic acid; the burnt, in tarry and scorched substances; and the caprylic, in cheese and rancid fat.

Like all the colors that result from mixing three primary hues, every odor from that of the rose to the skunk's appears to consist of a blend of these four primary odors.

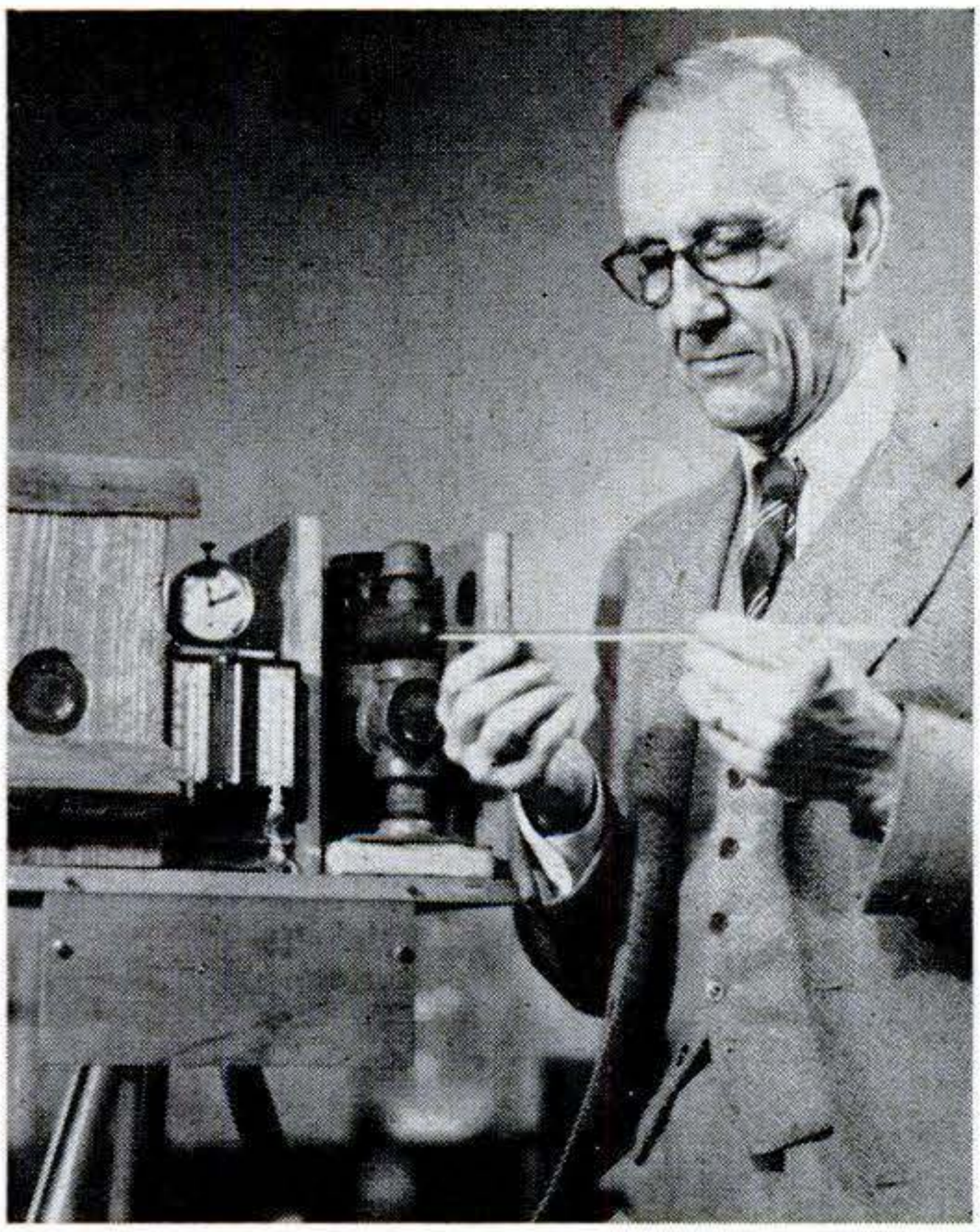
Suppose you invent an arbitrary scale, ranging from zero to eight, for measuring the intensity or strength of each of these ingredients in a complex smell. Now imagine that a certain odor proves to have a fragrant intensity of six, an acid intensity of four, a burnt intensity of two, and a caprylic intensity of three. What have you got? Nothing other than the smell of a rose! At last this elusive fragrance can be pinned down and defined, beyond all uncertainty, simply by the number 6423.

This is the Crocker-Henderson method of naming smells. Similarly, by simple four-digit numbers between 0000 and 8888, it will define any known odor. For example, the scent of camphor is 5735, and the smell of ethyl alcohol is 5414.

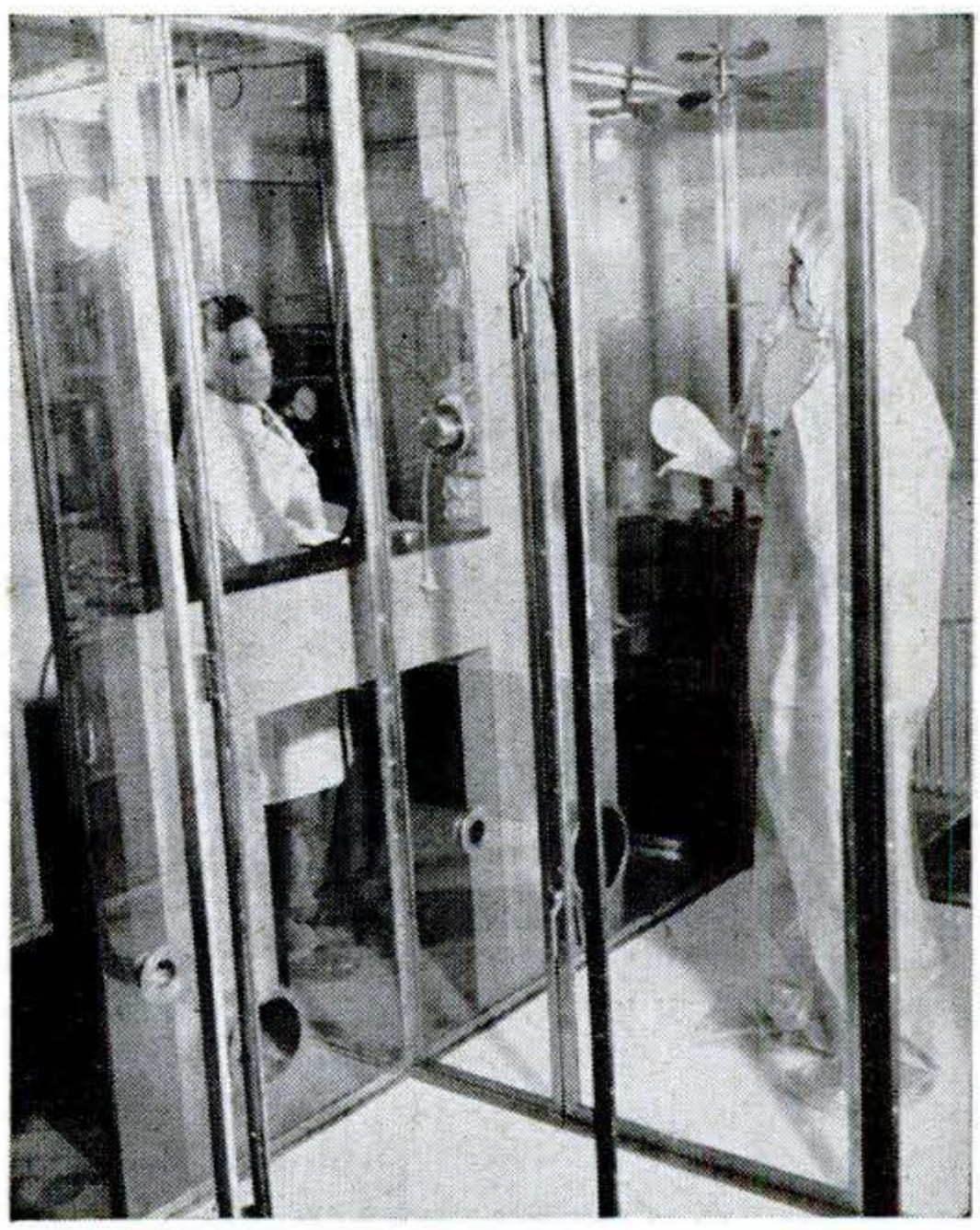
Finding the odor number of a perfume or of any other commercial product is made easy by an "odor-classification set" now on the market. Alternately the user sniffs a sample of the product and standard samples representing graduated intensities of each fundamental odor, until he finds the four "standards" that match. These standards are rows of vials containing especially selected liquids, such as ethyl alcohol to represent the No. 1 intensity of the burnt component. "Pure" fundamental odors, which do not seem to exist in nature, are neither available nor necessary for standards. Even an untrained person finds no difficulty in concentrating on one component of a complex odor at a time, while completely ignoring the others.

Given the number of an odor, conversely, you can tell what it will be like. A smell with a number ending in "8"—for the caprylic ingredient—will be fetid, rancid, garlicky, tarry, "metallic," or fishy. That's about the nearest that science has come to defining a stink.

The rest of the secret of what is an odor belongs to the realm of physiology and lies hidden in the two little dime-sized areas, at the roof of the nasal cavity, that make up the olfactory cleft. This is the seat of your sense of smell, the most mysterious of all human faculties. Microscopic



Airtight containers of honey, shown with and without "bird-house" camouflage, attract bees when fitted with plastic panes transmitting infrared rays. Test supports new theory of sense of smell offered by Prof. W. R. Miles (reading thermometer above) and Dr. L. H. Beck of Yale.



Glass walls of "smell-proof" room exclude unwanted scents while subject garbed in odor-free coveralls of fiber glass, at right above, sniffs aroma of sample in bottle. In this way, Cornell University experimenters are measuring how faint a smell the human nose can detect.

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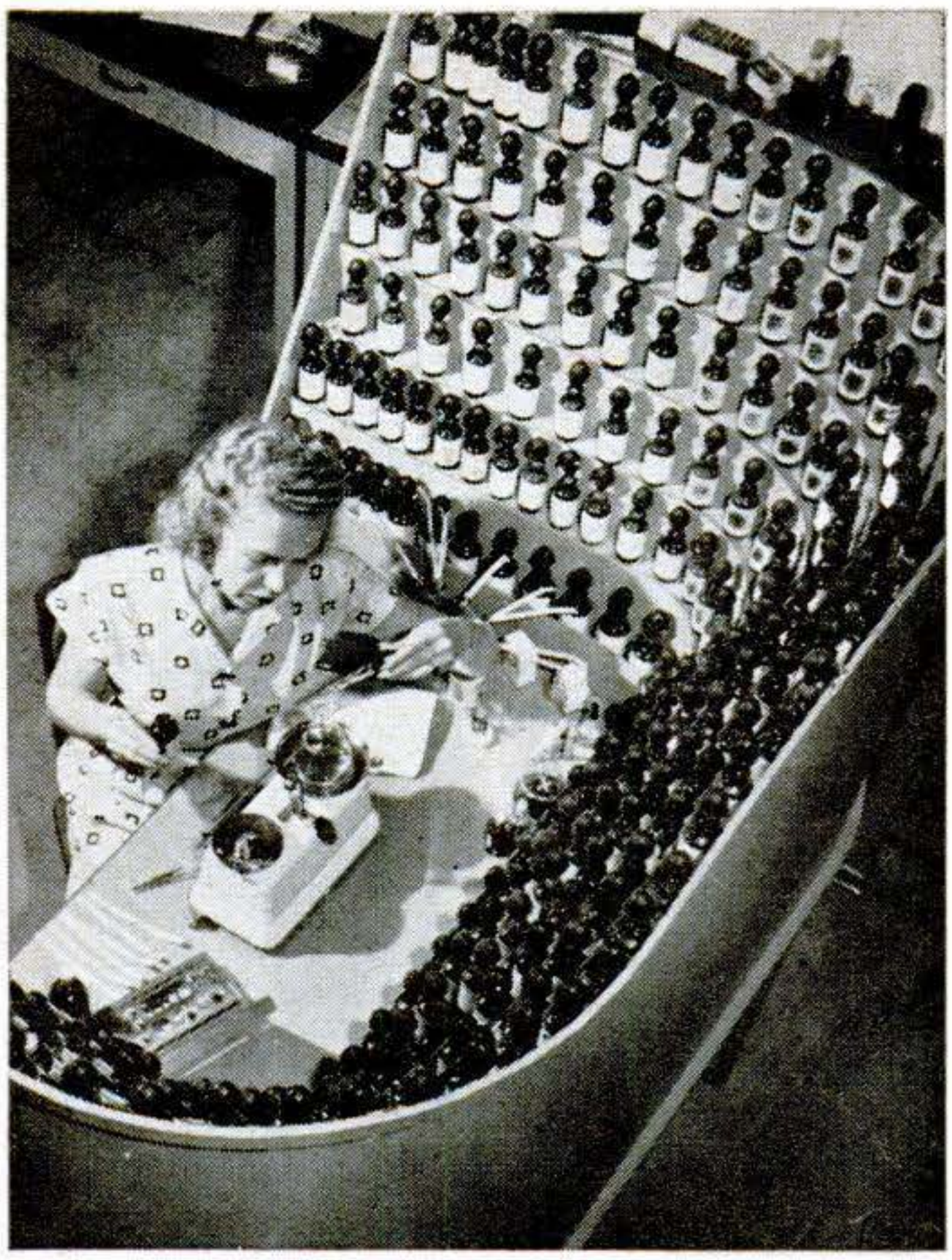

"Perfumer's organ" in Du Pont laboratory at New Brunswick, N. J., holds 300 different concentrated scents on racks. Girl cosmetician tests formulas of synthetic fragrances that will enhance sales appeal of household soap, cosmetics, and many other commercial products.

cells lining air passages and bearing tufts of tiny hairs somehow detect odors and tell them apart. How they do it and just what stimulates them have puzzled scientists since the study of physiology began.

Do airborne particles, settling upon the olfactory cells, produce chemical reactions that give rise to sensations of odors? We know for a fact that taste buds detect flavors by chemical reactions—but it strains the imagination to account for our sense of smell, 10,000 times as sensitive as our sense of taste, by the same mechanism.

Experiments conducted within the last two years at Yale University by Dr. Lloyd H. Beck and Prof. Walter R. Miles now indicate that the long-standing mystery may have been solved. Insects, which lead the rest of the animal kingdom in keenness of smell, were their subjects in the tests.

In one of their most striking experiments, the researchers placed fragrant honey in airtight containers, picturesquely camouflaged as bird houses, from which no smell could possibly escape. Then they liberated bees nearby. The bees swarmed around some of the boxes, pointedly ignored others. Boxes that attracted the bees all had windows of plastic panes, which would transmit invisible infrared rays of a wave length of exactly 8 to 14 microns, or thousandths of a millimeter. The other boxes had exactly similar plastic windows, but these were also covered with glass panes that did not transmit infrared rays.

From this and other trials, which now are being extended to human subjects, the experimenters offer the following amazing explanation of the sense of smell:

Human organs of smell, like those of the insects used in the tests, resemble miniature radar stations. In common with the rest of the body, they constantly emit radiant heat or infrared rays. When these rays strike substances that have odors, they are absorbed, instead of being bounced back like radar waves. Just as loss of radiant heat chills your hand when you hold it over an ice-cube tray, olfactory cells can detect the absorption of the rays they emit when airborne particles enter the nose and come within range. In their case, instead of a feeling of chilliness, a sensation of odor results.

Wave Length Determines Odor

As has already been known, substances with different odors absorb different wave lengths of infrared. Presumably, individual olfactory cells emit correspondingly different wave lengths. At any rate, what odor you smell depends upon the particular wave length absorbed. For a substance to have an odor at all, this wave length must lie between 8 and 14 microns. Your sense of smell doesn't respond to wave lengths beyond that range, any more than your eye can see light of wave lengths beyond the range of the visible spectrum.

Unlike the "chemical" theory, which the experiments seem to disprove, this ingenious new one appears to fit all the known facts. By eliminating the need for airborne particles to come in actual contact with the smell-detecting cells, it explains how your nose can detect fantastically small amounts of a substance. It helps, too, to understand the incredibly keen scent of insects—whose external organs of smell, in their antennae, may be "long-distance radar stations." And, if confirmed, the Beck-Miles explanation may have far-reaching practical applications in the industries to which an understanding of the sense of smell is so important. END

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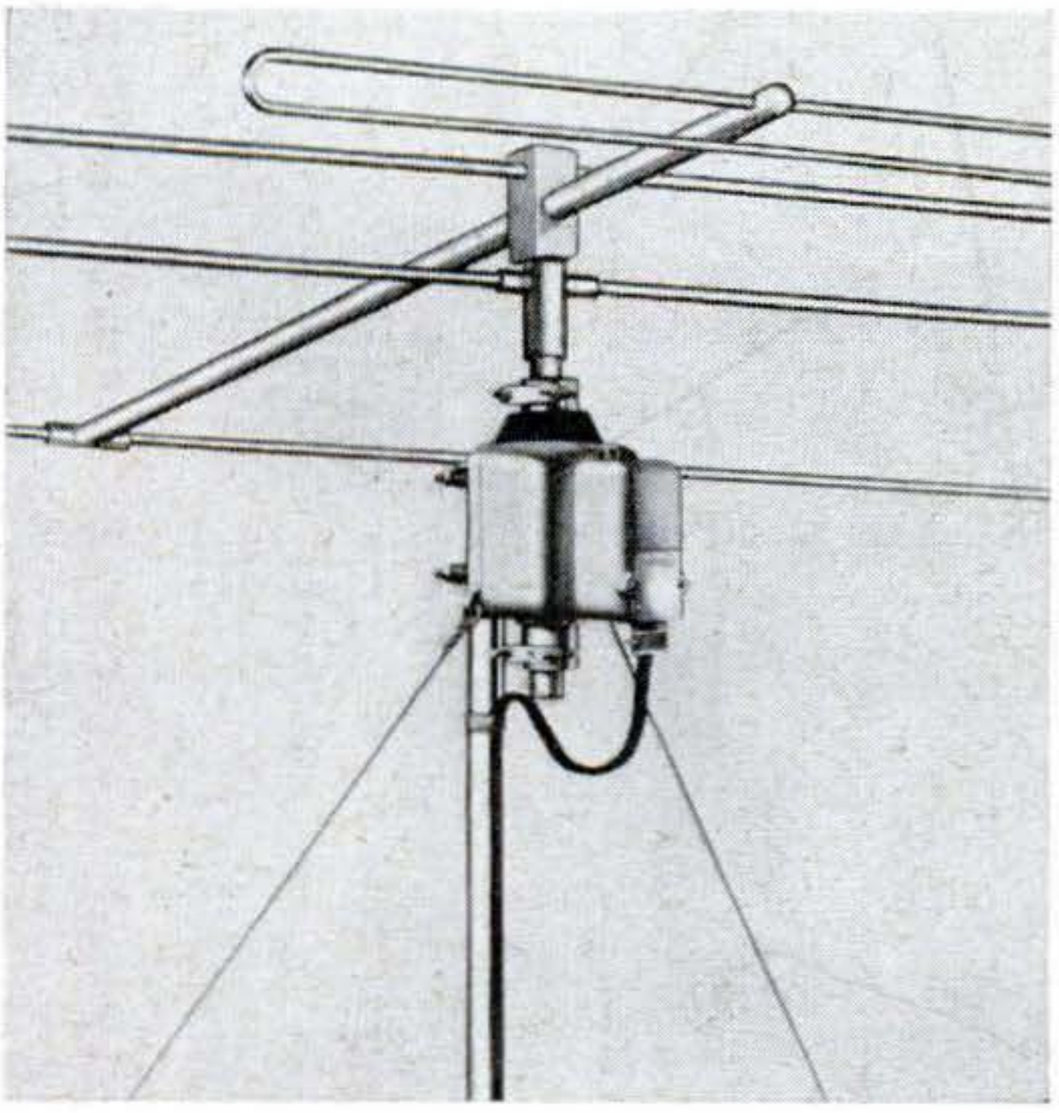
TV Sets Give Bigger Pictures

THERE's no waste of tube space in these new Zenith (left) and Garod (right) television sets. By spreading the standard rectangular image over the full face of the tube, they provide a circular picture 50 percent larger with only a small amount cut off at the corners. Thus a blown-up image on a 10-inch tube is actually larger than a standard image on a 12-inch tube. The Garod set features a remote-control switch on a 15-foot cord by which the viewer can select the blown-up or standard image. The Zenith provides for possible future TV reception over telephone lines.



Rooftop Motor Turns Antenna

YOU can rotate your TV or FM antenna to the exact point where reception is best with this Tenna Rotor ®. It is mounted on the roof and has a 110-volt electric motor that rotates a hollow shaft into which the antenna mast is clamped. It turns the antenna 360° in either direction and is controlled from inside the house by a switch.

Mirror Becomes TV Screen

WHAT looks like an ordinary wall mirror becomes a television screen in this Sightmirror ®. The TV receiver, with its 15-inch tube, is recessed into the wall and covered with a special mirror that lets the picture show through when the set is on. It can be operated from up to 30 feet away with a remote-control box (left foreground).

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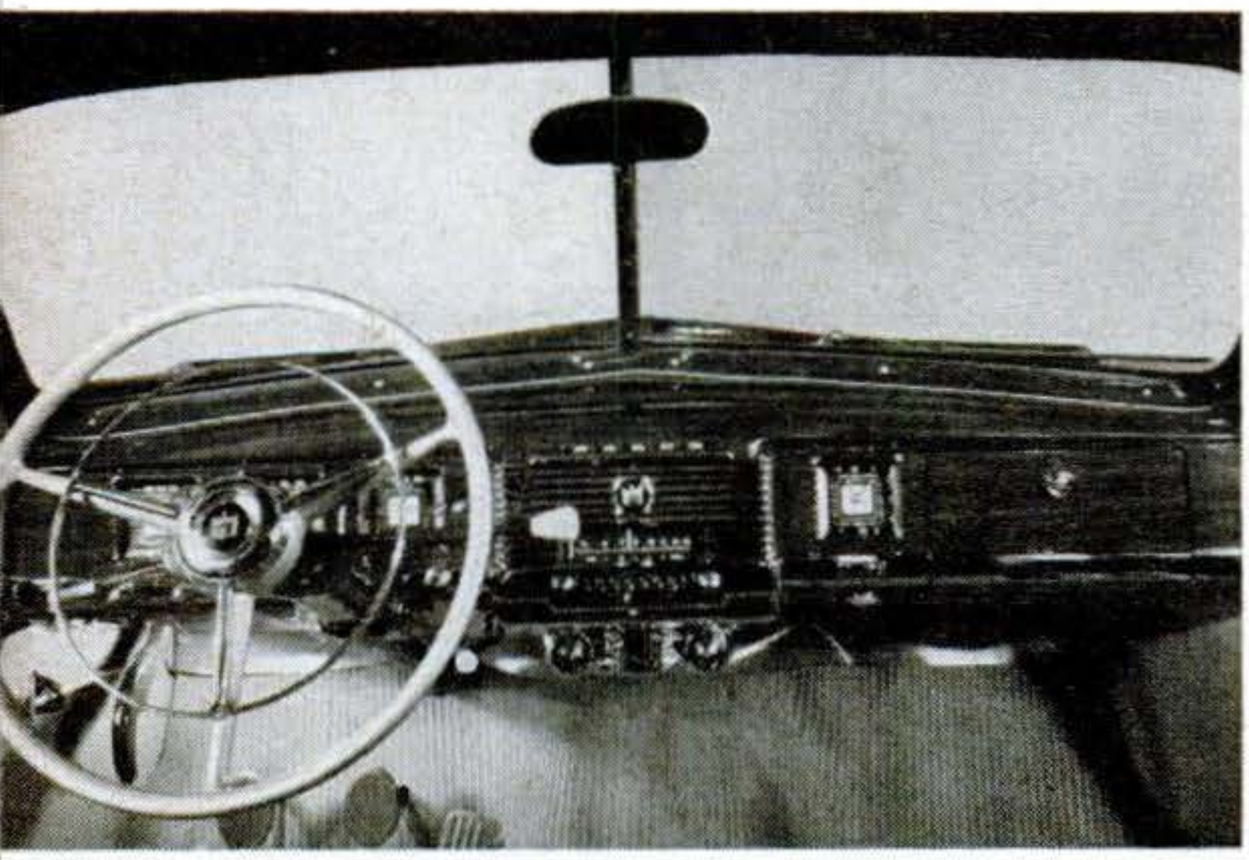
'49 Dodge: More Room in Less Space

THE 1949 Dodge, announced late in February, reverses the automobile trend toward bulkiness. But though height, width, and length have been reduced, the new models actually have more room inside than last year's. This has been accomplished by swelling out the side body panels.

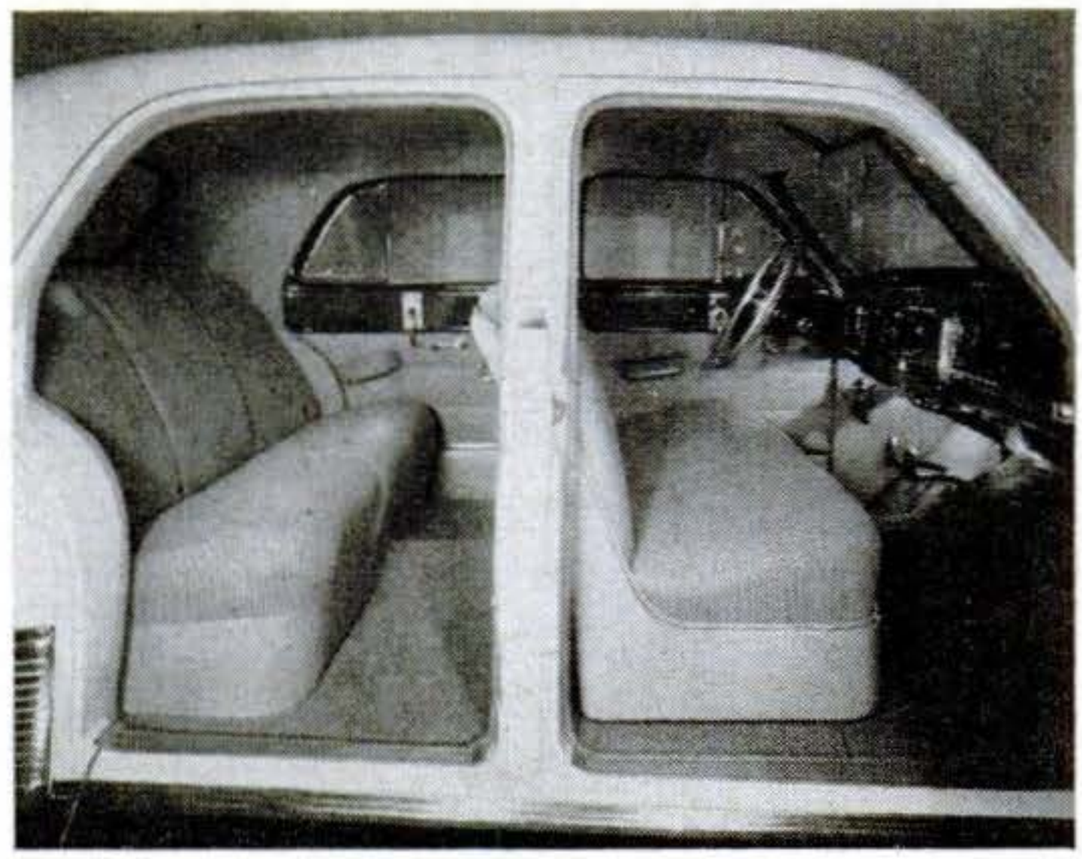
The Dodge division of the Chrysler Corp. has also made a move to meet complaints about the high price of cars. Emerging ahead of Plymouth as the sales leader of the Chrysler line, Dodge will offer a priced-down model called the Wayfarer® with a 115-inch wheelbase. This is 8½ inches shorter than that of the higher-priced Coronet® and Meadowbrook® models.

Engine compression ratio in the new Dodges has been boosted to 7-to-1. Windshield area is increased by 24 percent. Larger rear windows cut down blind spots. By Cycle Bonding® brake linings, Chrysler Corp. this year eliminates the riveting that in the past has scored the drums.

Important to the motorist conscious of repair bills are fender units that can be removed simply by unbolting them.

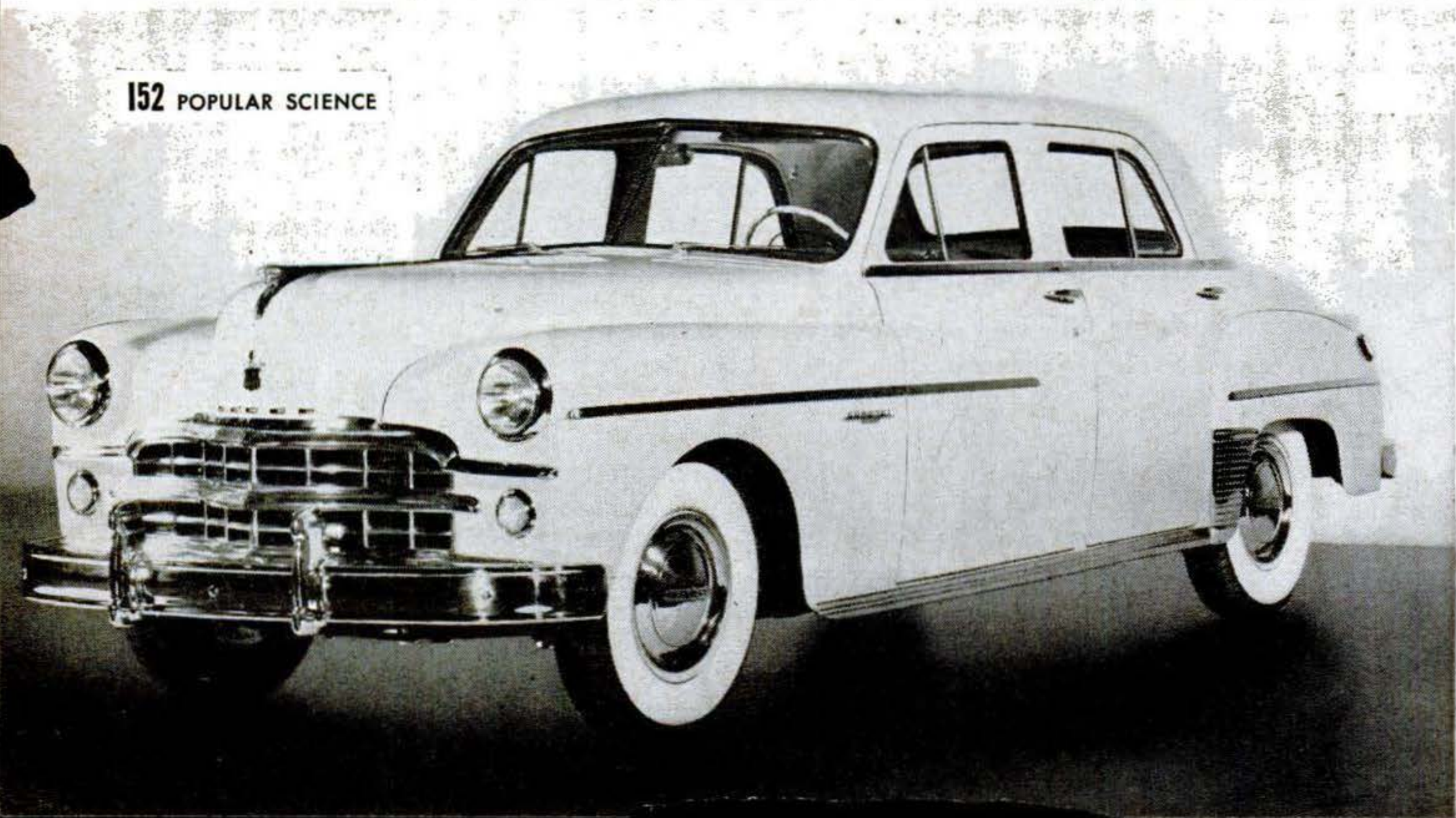


Instruments of new Dodge are recessed to avoid light reflections. Car is slightly shorter, 3 in. narrower, 2 in. lower. Wheelbase is 4 in. longer. Headlights are higher off road.



Front seats are 6 in., rear seats nearly 8 in., wider. Headroom is 37 in. Instrument panel is moved ahead 4 in. to lengthen passenger compartment. Rear doors are hinged at center post.

Four-door Coronet® model (below) typifies body lines of new Dodge, produced in 11 styles.



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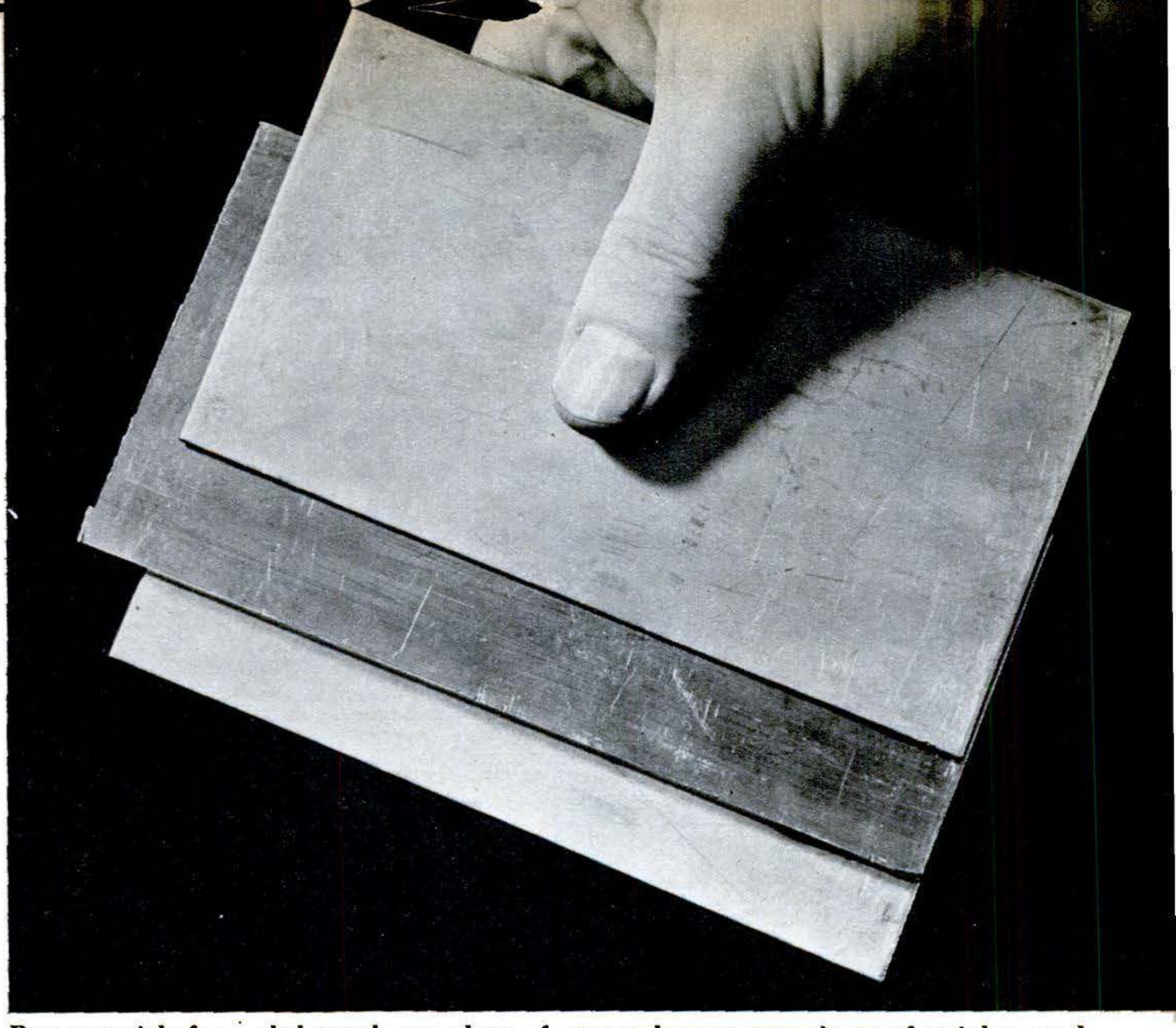

Raw materials for a clad metal: one sheet of copper between two sheets of stainless steel.

Married Metals Improve Both Pots and Planes

Cladding copper and steel, steel and stainless, silver and bronze creates new materials combining old advantages.

By George H. Waltz, Jr.

PS photos by Hubert Luckett

SHEET metal with a dual personality now is being formed into shiny, quick-heating pots and pans for your kitchen. Pressed from thin metal sandwiches consisting of a sheet of copper between two sheets of stainless steel, the new utensils combine the easy-to-clean quality of stainless steel with the high heat conductivity of copper.

Because stainless steel is strong as well as easy to keep clean, it long has been used for pots and pans. Unfortunately, however, while it is one of the best noncorrosive metals, it also is one of the poorest conductors of heat. Compared to copper, the "master conductor," its ability to conduct heat is only 6.1 percent. Stainless-clad copper, of the type being used

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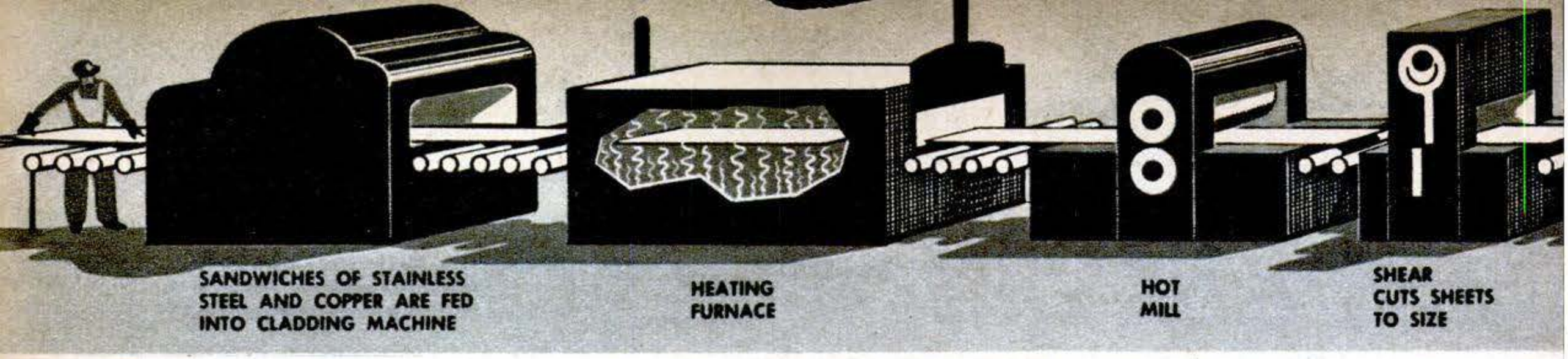
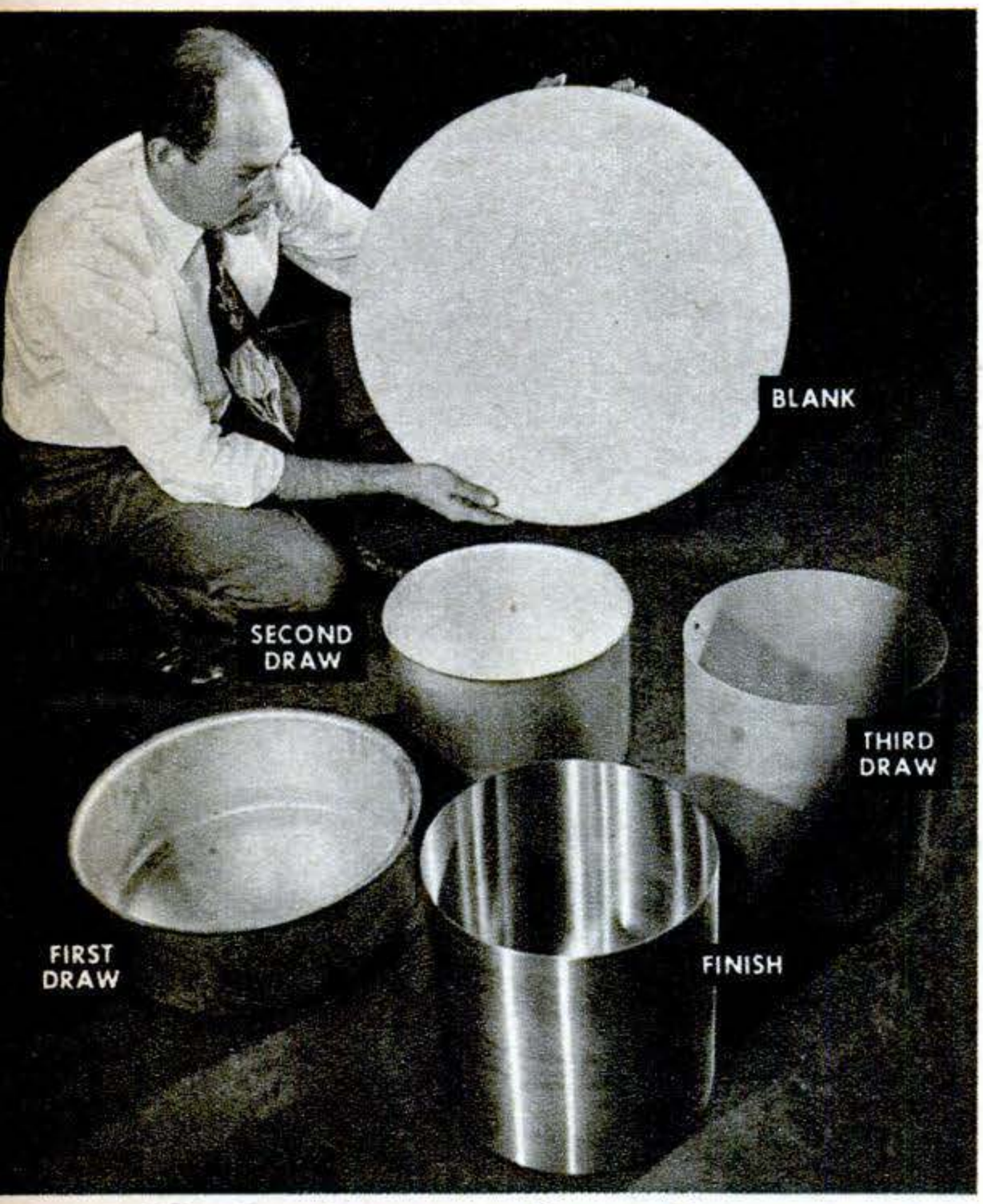


Flow chart above and on the next three pages shows how copper is clad with stainless steel.



Hotel cooking pots of copper between stainless steel are shown at various stages of their production by Lalance & Grosjean Mfg. Co. at Woodhaven, L. I. Photos below show how they're made.

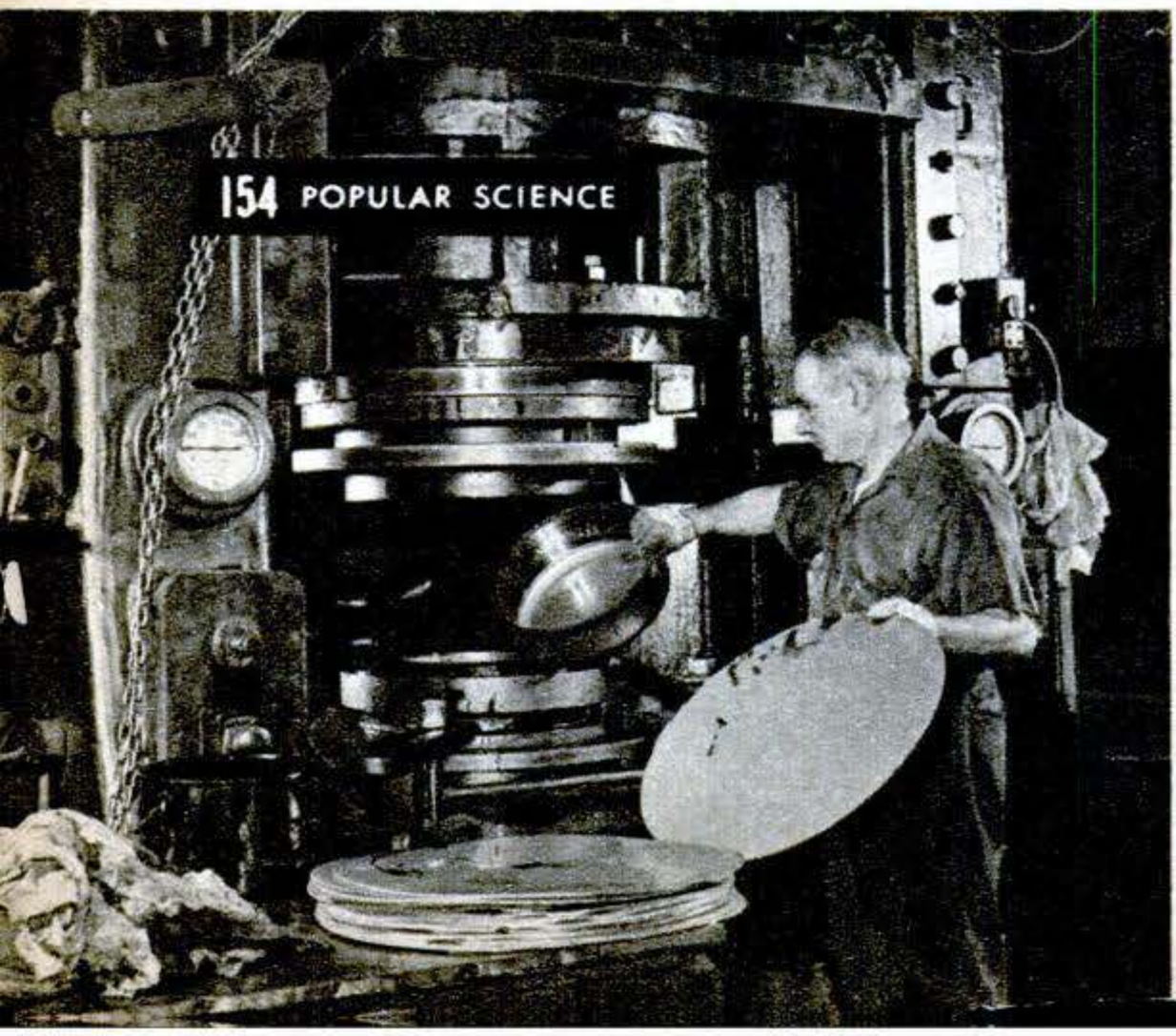
for the new utensils, on the other hand, scores better than 54 percent—more than half as good as highly corrosive copper alone and nine times better than the noncorrosive stainless steel alone. Fashioning kitchen pots and pans from the new stainless-copper-stainless sandwiches utilizes the best properties of each metal: the utensils not only heat well, but they are strong and easy to keep spotless.

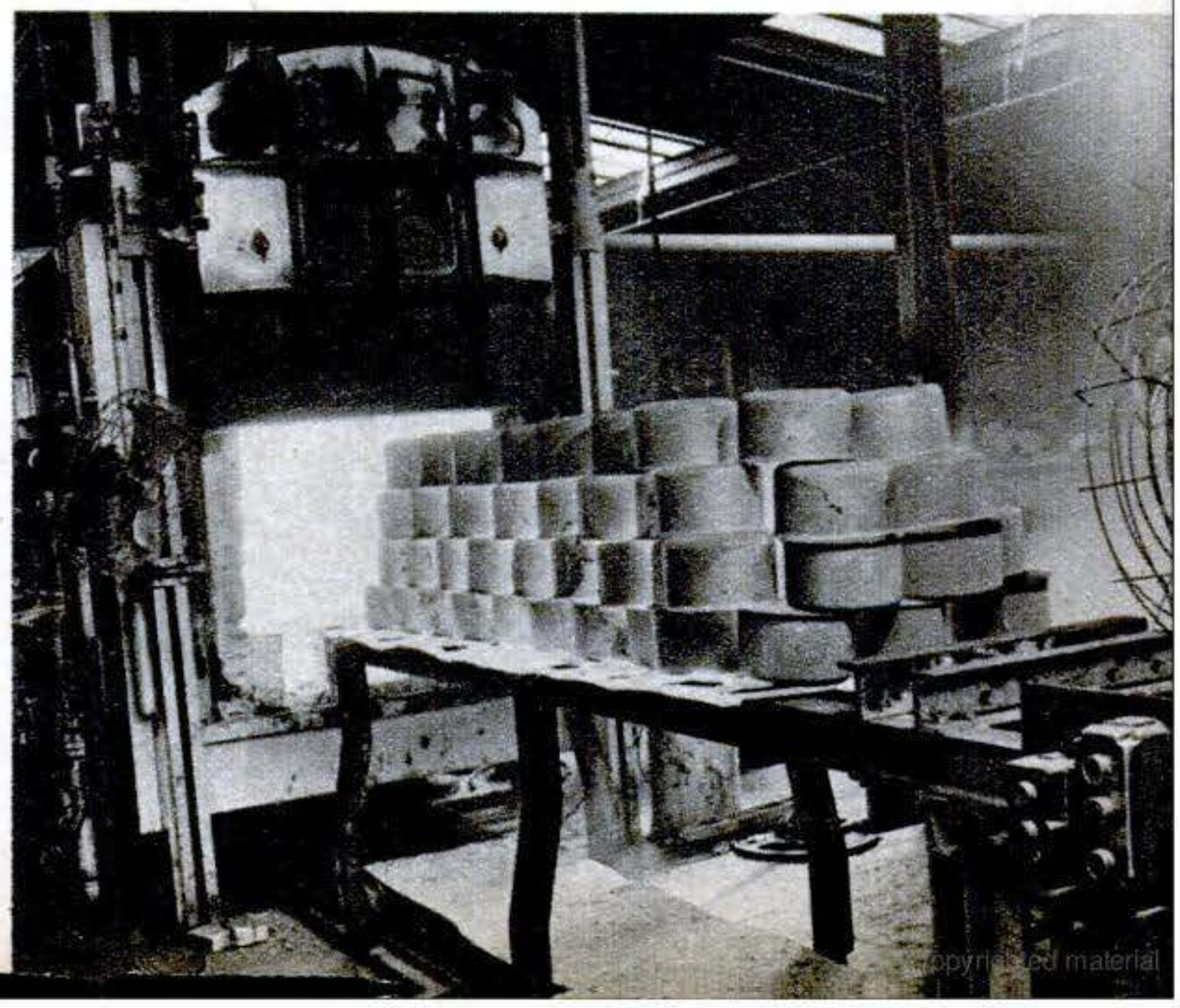
The main importance of these new steel-copper-steel pots and pans, however, goes far beyond their convenience to the housewife and the restaurant chef. They mark a milestone, for they are another *first* in the fast-growing clad-metals industry.

Basically, a clad metal is one made of two dissimilar metals that have been permanently bonded into a rolled sheet or product. The process is not electroplating, and it uses no cement or binder. The dissimilar metals are simply pressed together between the wringer-like rolls of a cladding machine. By applying just the right pressure at just the right temperature for just the right length of time, the process bonds the metals together molecularly, and no amount of tension can pull them apart. A cross section of a clad metal viewed under a microscope shows that some of each metal has diffused into the other to form a

Hydraulic press shapes deep pots from disks of clad metal. Drawing out the metal is done in three steps. In photo below, operator shows how pot looks before and after the first draw.

Pots are annealed in this large gas-fired oven (below) before each trip to the press. The pots shown have been through the initial drawing and, when they cool, will be drawn again.





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Bonding requires just the right pressure at the right heat and for the right length of time.

tenacious bond that is an alloy of the two.

Clad metals are not new. The idea is perhaps some 6,000 years old, but it took the needs of World War II to bring it into wide use. The first clad metal on record was used by the early Egyptians, who hammered soft silver into copper to form a workable material for their ornate jewelry. The first Sheffield plate, made by 18th century craftsmen in Sheffield, England, was basically a clad metal, too. Soft pure silver was hammered onto copper to make this hand-wrought tableware durable as well as beautiful. Later, in Pforzheim, Germany, jewelry makers clad copper with gold to obtain rigidity in delicate ornaments.

Steel Bullets Clad with Copper

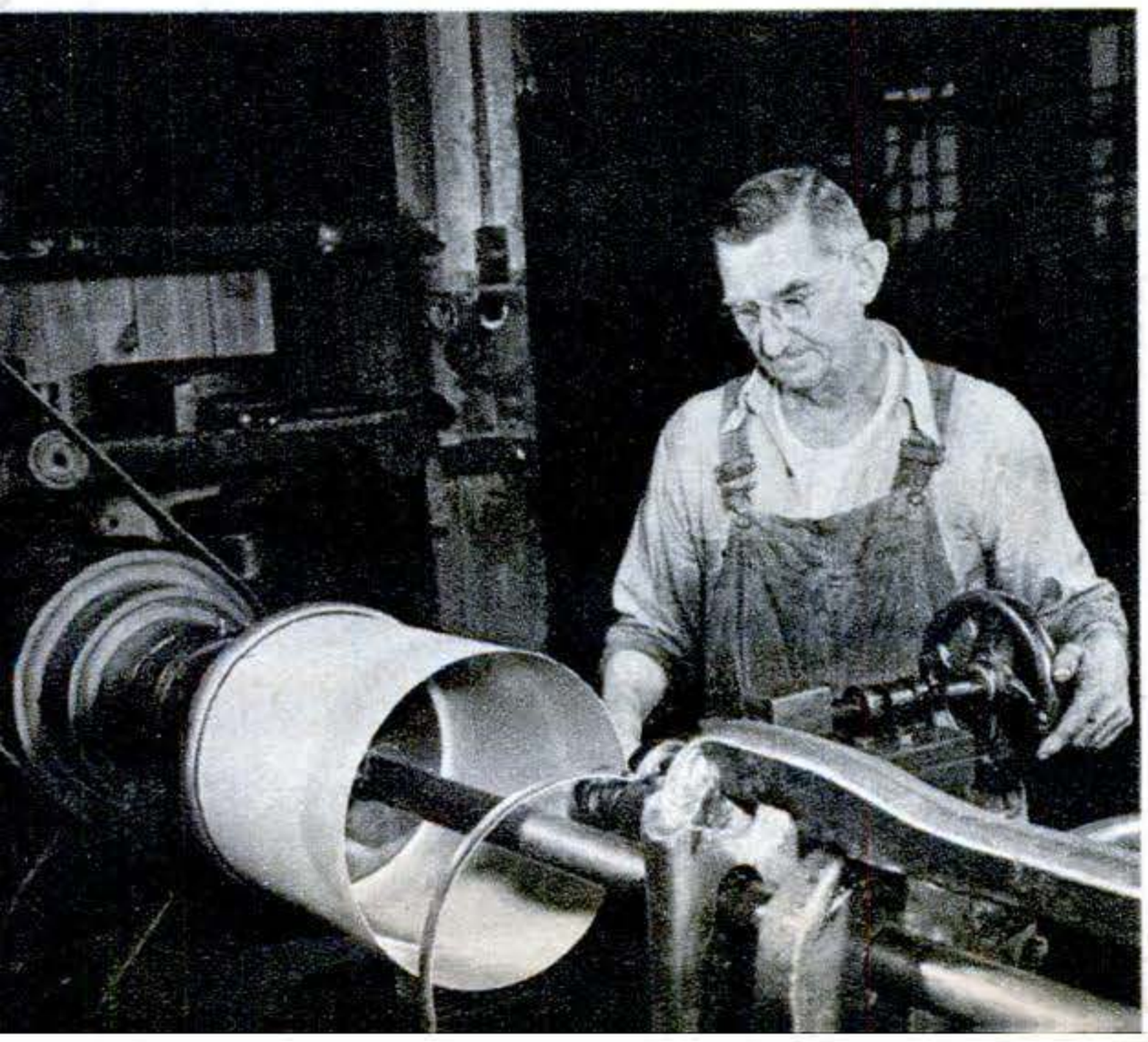
Although a few European arsenals during World War I made bullet jackets by cladding copper alloys onto steel, it was not until World War II that all nations not only fired copper-clad steel bullets but used clad metals in many other ways. Shortages of some metals made cladding necessary to piece out the supply; in other cases, the unique results of combining metallic qualities made cladding desirable.

Since the war, the peacetime uses of the clad metals—stainless steel and copper, carbon steel and copper, stainless steel and carbon steel, carbon steel and nickel, silver and mild steel or bronze—have increased by leaps and bounds. At last count, in the United States alone there were a dozen large producers of clad metals.

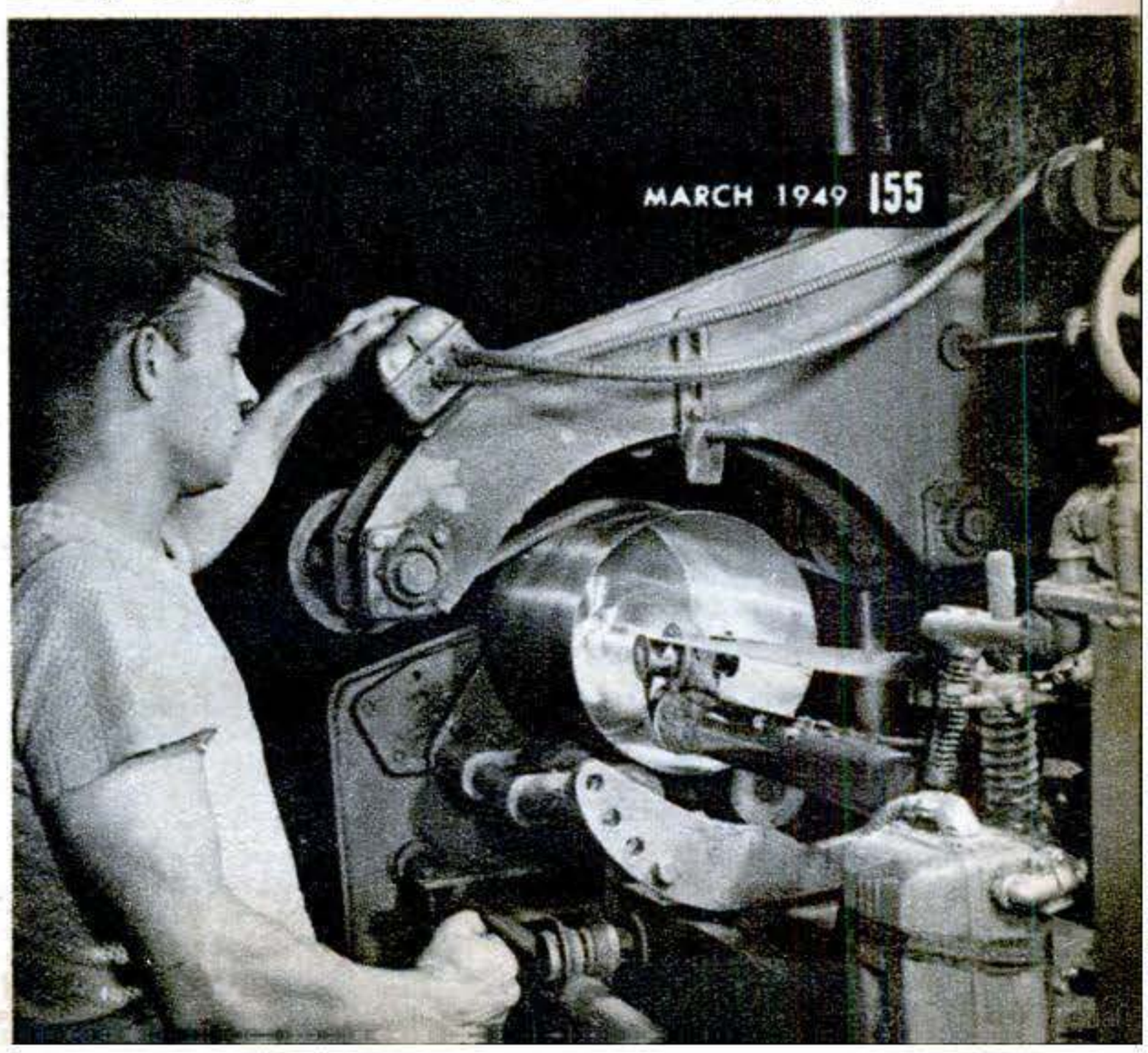
In industries ranging from aviation to zymurgy (brewing), design engineers are finding more applications for clad metals. They lend themselves particularly well to industrial processes in which large vats, used for storage, heating, or mixing, must both conduct heat well and be easy to clean. Fragile glass-lined tanks for storing and transporting milk are being replaced by tanks of sturdier steel clad with stainless steel. The steel gives strength, while the stainless steel provides a noncorrosive, easily cleaned surface. Tile-lined vats used in the paper and pulp industry are making way for vats of the stainless-clad steel.

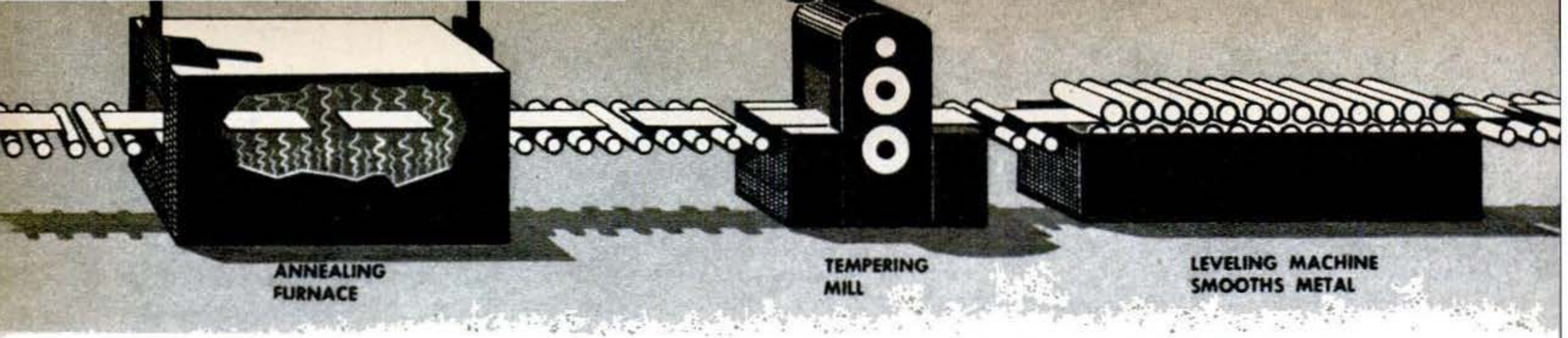
One cereal manufacturer had for years been using tanks lined with carbon steel for mixing the salt and vinegar that went into his recipe. Because corrosion caused the steel to flake off, he had to employ a series of electromagnets to remove the metal chips from his finished product. Processing equip-

After three drawings, the pots are cleaned and placed in the trimming machine below. As the pot is revolved, a circular knife evenly slices off the ragged rim of excess metal at the top.

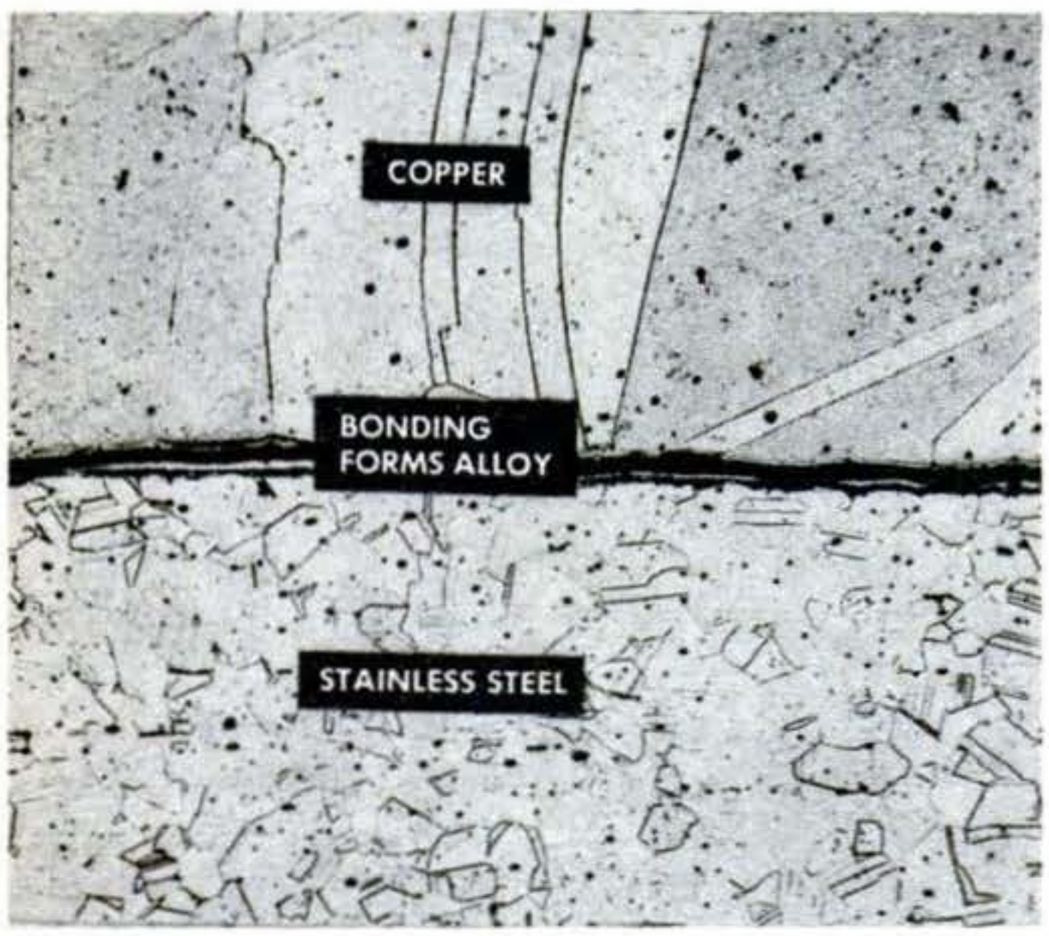


Polishing machine automatically burnishes the pot after it has been cleaned and trimmed. In photo below, the inside is being finished. An emery belt provides the polish as the pot spins.





Cladding process shown here and on previous two pages is used by American Cladmetals Co.



In microscopic view of clad metal, showing a partial cross section magnified 200 times, you can see how the two dissimilar metals are bonded by fusing into an alloy where they meet. Their molecules actually mingle to form a permanent bond that is as strong as the metals themselves.

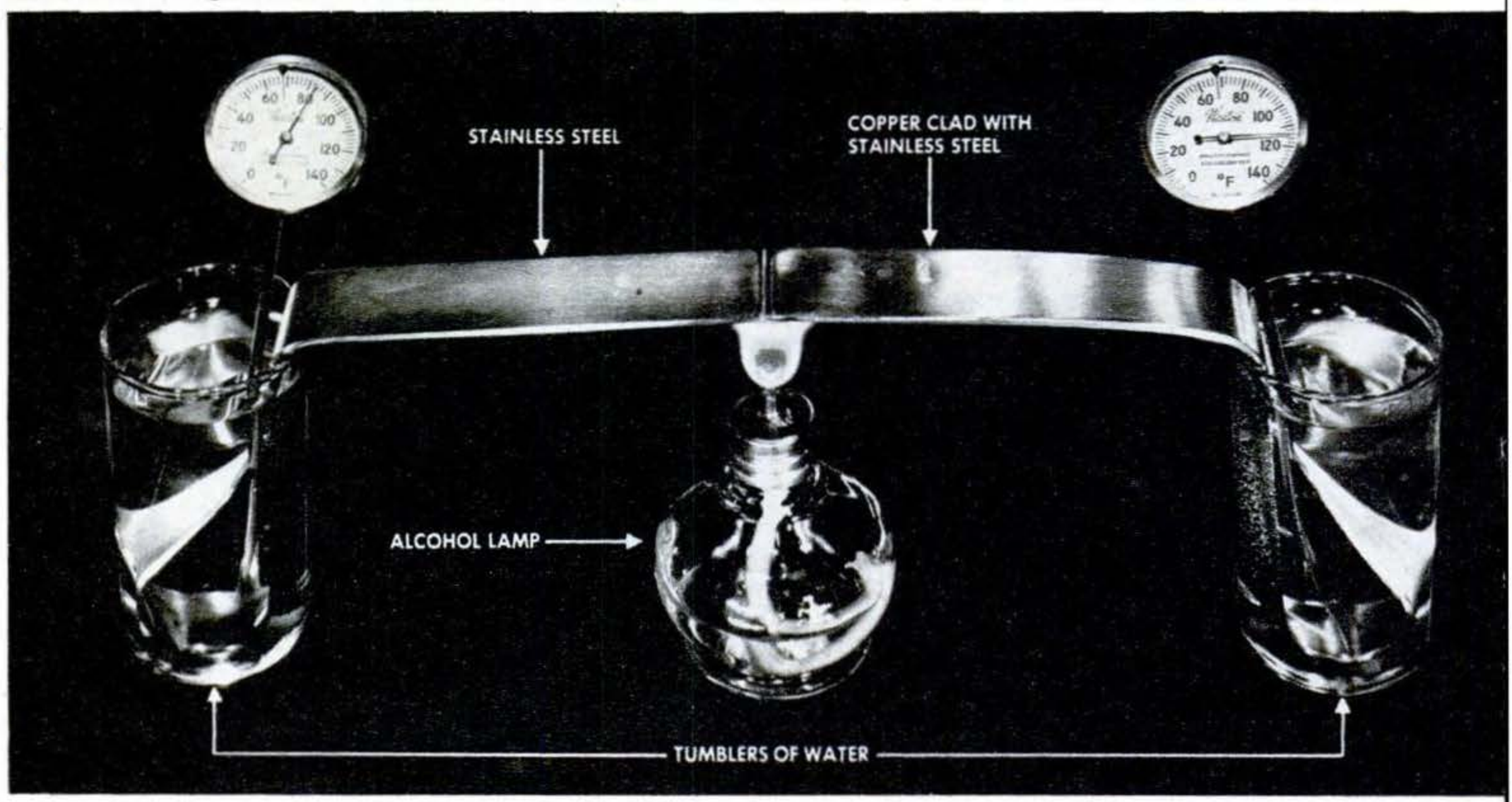
ment made of stainless-clad steel has now solved his problem for him.

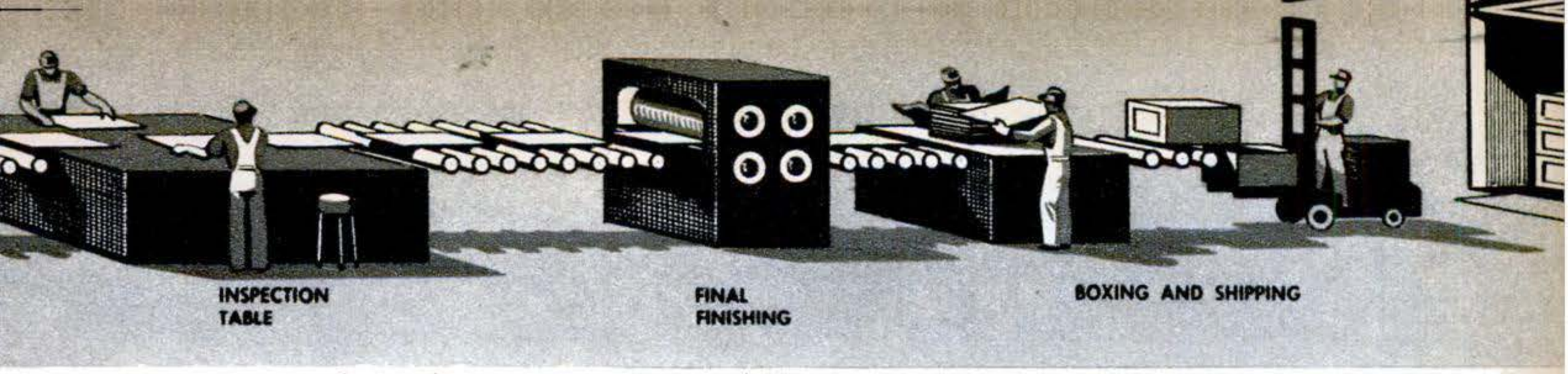
The automotive companies are experimenting with clad metals along many lines. Engine manufacturers are exploring the possibility of using silver-clad carbon steel for low-friction, high-speed bearings. The accessory people see in stainless-clad steel an excellent material for automobile bumpers, headlight and fog-light shells, and hub caps.

With higher and higher operating pressures in automobile engines (PS, Jan. '49, p. 166), the failure of engine gaskets is becoming more and more of a problem. Gaskets made from a sandwich of copper over carbon steel show good promise of providing the answer. The central filling of steel gives the necessary strength, and the copper, as in the conventional gasket, provides a soft material to form a firm seat.

Similarly, clad metals are finding many

Simple experiment (below) shows clad metal's superiority to plain stainless steel as heat conductor. Water in both tumblers was 70° F. at start. Now temperature of water heated through clad metal has risen more than three times that of water heated through stainless steel. Under controlled laboratory conditions, the difference in conductivity proves more than nine times.





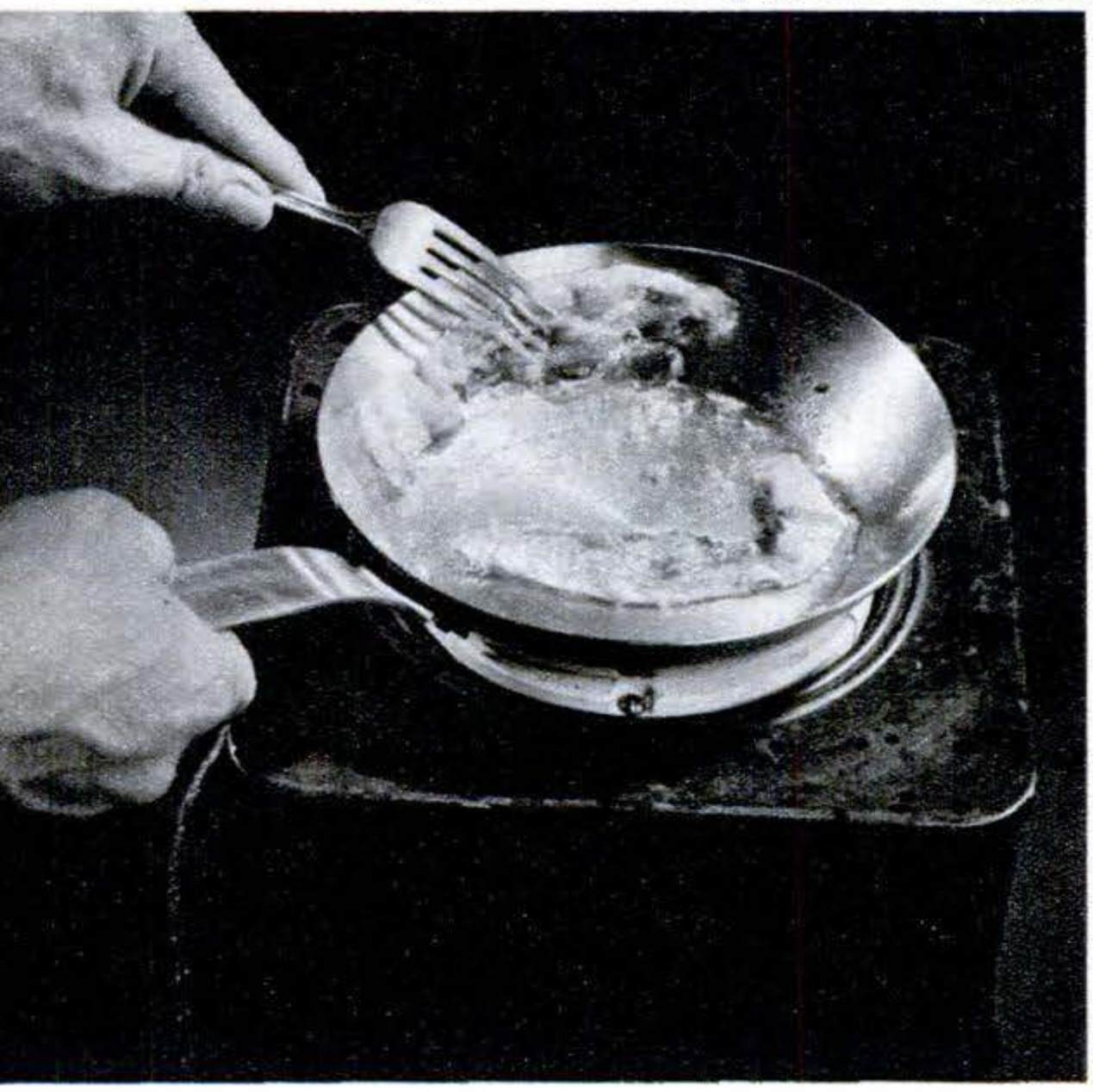
Three metal sheets emerge as molecularly bonded sandwich from Carnegie, Pa., cladding plant.

uses in the electrical industry. The process of cladding makes it possible to put a thin layer of silver, gold, or platinum on strips of bronze or other metal to be used as electrical contacts. Although only a small amount of the expensive metal is used, it provides a nonpitting, noncorrosive surface particularly valuable in ignition and similar circuits.

In long lines for transmitting electric power, copper is still the most efficient conductor. But copper forms a relatively weak wire that literally pulls itself apart under its own weight when stretched unsupported for long distances. By cladding a steel wire with copper, power companies now couple the high conductivity of copper with the great strength of steel. Copper-clad steel wire accounts for practically the entire output of one large clad-metal producer.

The copper-clad steel wire is drawn from an ingot of steel that has been carefully centered in a graphite mold and surrounded with molten copper. A molten weld takes place and the resulting billet consists of a steel center covered on all four sides with an outer coating of copper. The billet is then rolled and drawn.

Frying pan of copper clad with stainless steel (below) heats so evenly, because of superior heat conductivity, that ends of bacon up on its sides cook just as fast as portions in center.



Clad Metals vs. Shortages

Clad metals have won more friends in industry by providing substitutes for scarce metals. Not long ago, when a shortage of tin made it difficult for a large manufacturer of gas meters to maintain peak production, the company shifted to a clad-metal sandwich of carbon steel between sheet copper. Although this started as a stop-gap operation to combat the lack of sheet tin, the copper-steel-copper meters proved so superior that the manufacturer has continued making them in spite of their higher cost.

But the big reason for the growing popularity of clad metals is their dual personality, combining the best traits of two dissimilar components. In aviation, for instance, their versatility is solving two important problems—providing strength without excessive weight, and heat conduction without corrosion at extremely high temperatures. Aluminum-clad duraluminum ribs and spars add strength to big airplanes like the Navy's big flying boat Mars. And exhaust cones of the same sort of stainless-copper-stainless material used in the new pots and pans is helping to beat the heat and corrosion of the fiery exhaust gases that stream out the tails of giant rockets.

If and when we shoot a rocket to the moon—and the first attempt may not be too far in the future—clad metals will make the trip. END

DDT Toughens Flies

THE U. S. Department of Agriculture reports a complication in the war on insects: their tendency to develop resistance to insecticides. In laboratory tests, stronger and stronger dosages of DDT have been required to kill successive generations of houseflies.

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How's Your Plane IQ?

If you're air-minded, you should get a good score on naming these transport planes. Give it a try, then check the answers printed upside down at the bottom of these pages.

1. This new air liner adds 100 miles an hour to older twin-engine transport performance, nearly doubles passenger capacity.

4. Twin-boom tail makes it easy to identify this new Air Force flying boxcar. It can carry 42 fully equipped men or 10 tons of cargo.

5. And here's a triple-tail, four-engine job you've undoubtedly seen many times. It's in regular commercial air-line service today.

8. Here's a veteran of four-engine flight with both the air lines and the military. A prewar entry, it is still going strong.

9. Might be a twin of its neighbor at the left, but is a lot faster. Note the square cabin windows, an identification feature.

6. Douglas DC-3; 7. Martin Mars®; 8. Douglas DC-4; 9. Douglas DC-6; 10. Convair XC-99; 11. Convair Liner® (240).

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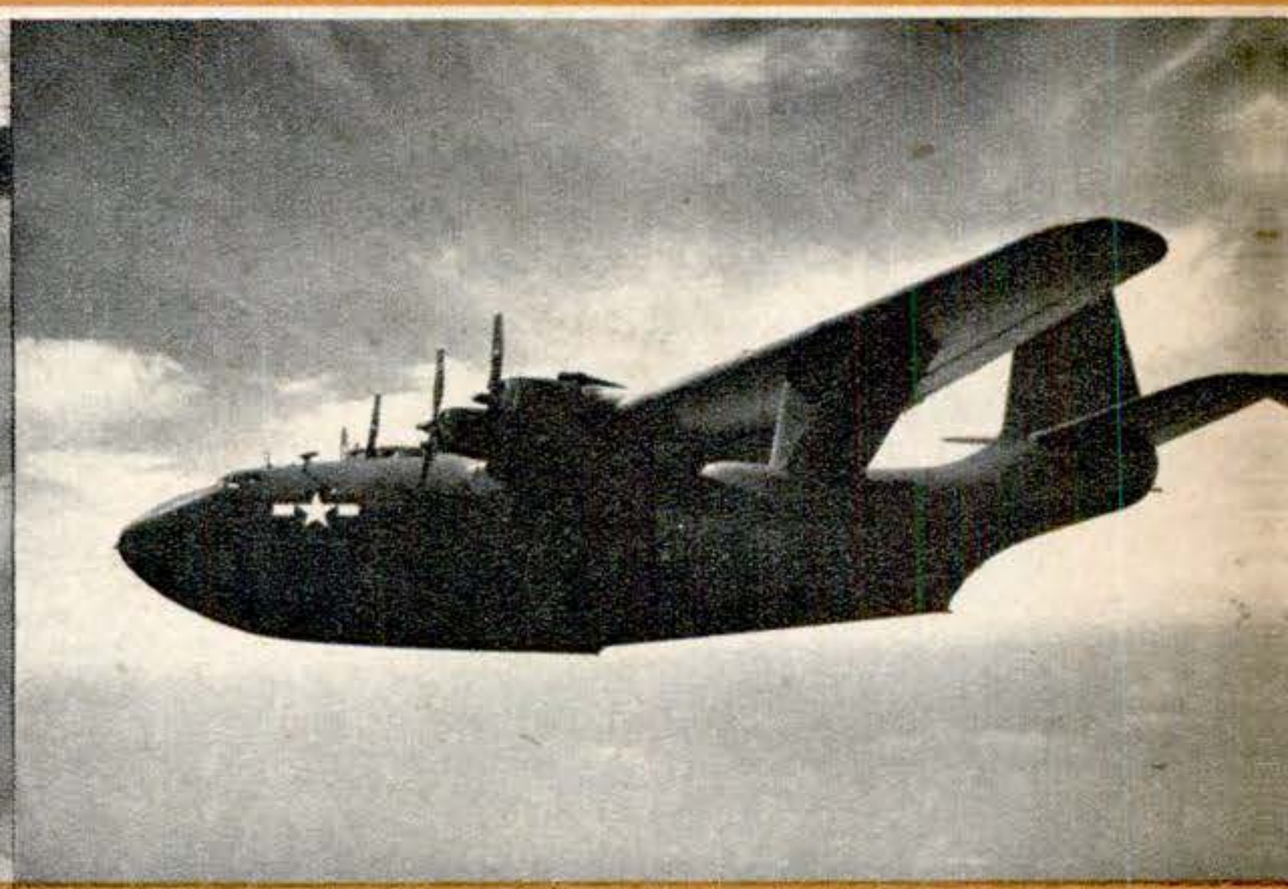
2. An 180-passenger Navy giant gets the thrust of six rockets added to the normal 14,000 hp. of its four Wasp Major® engines.

3. The double-deck cabin of this big fellow, the largest and fastest commercial landplane, accommodates 75 passengers.

6. If you're an air traveler, you've probably flown in this popular old-timer. As the C-47, it was a workhorse during the war.



7. The world's largest flying boat in active service, pride of the Navy, recently flew nonstop from Honolulu to Chicago.

10. Presenting the military-transport version of a six-engine Air Force bomber. It can haul 400 men or 50 tons of cargo.

11. Another new entry in the twin-engine field is this 300-m.p.h. medium-range transport now in service on the air lines.

1. Martin 2-0-2; 2. Lockheed Constitution®; 3. Boeing Stratocruiser®; 4. Fairchild C-119; 5. Lockheed Constellation®;

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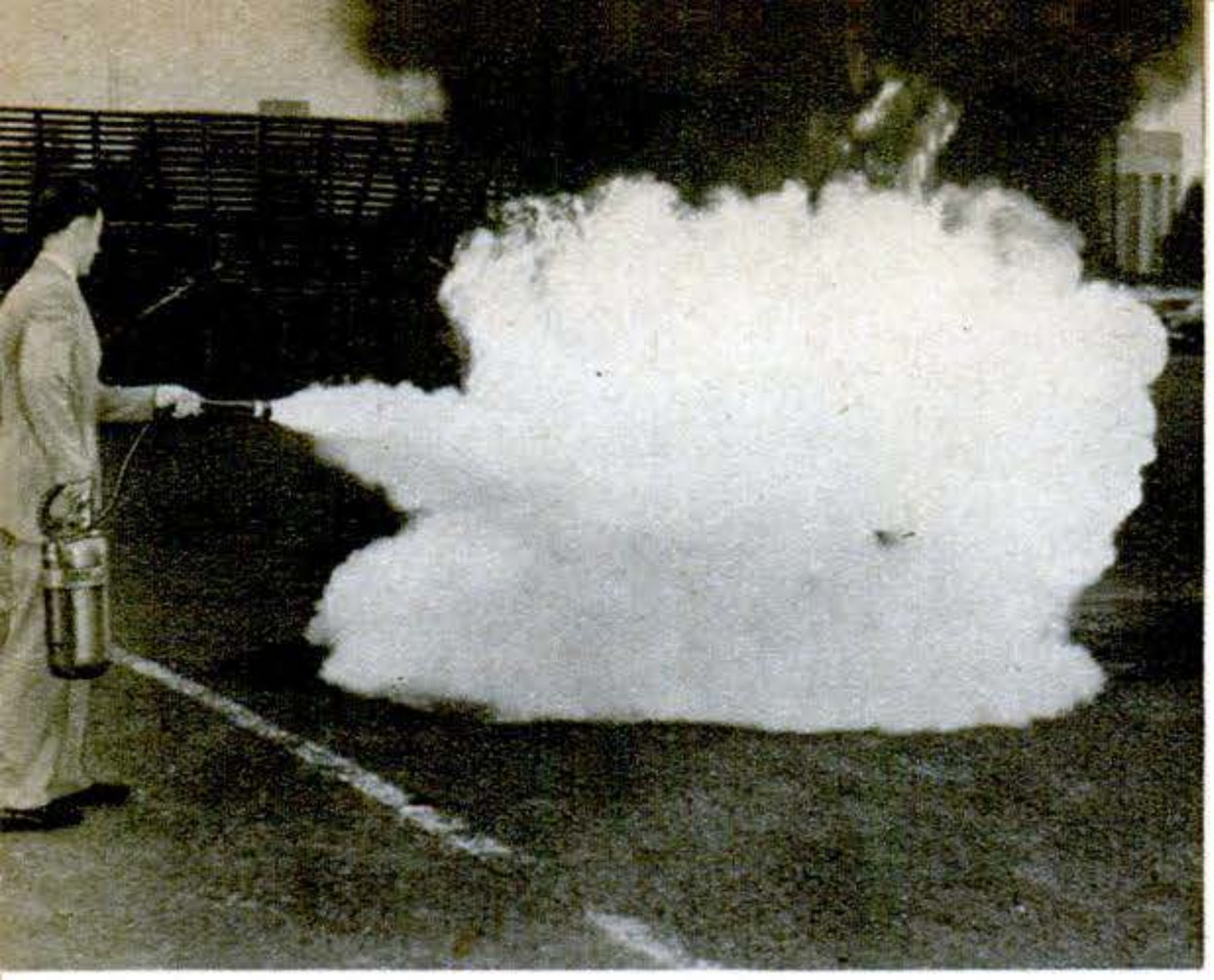
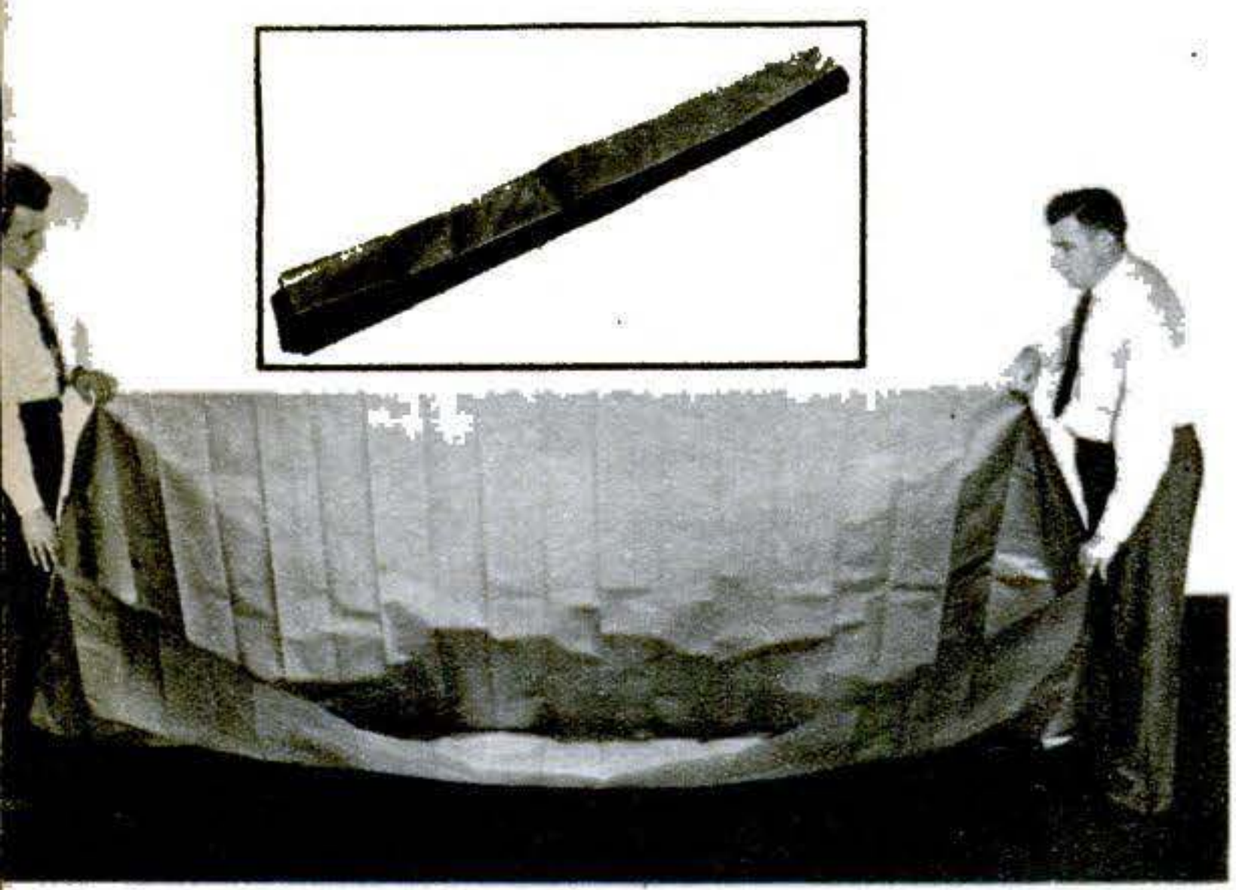


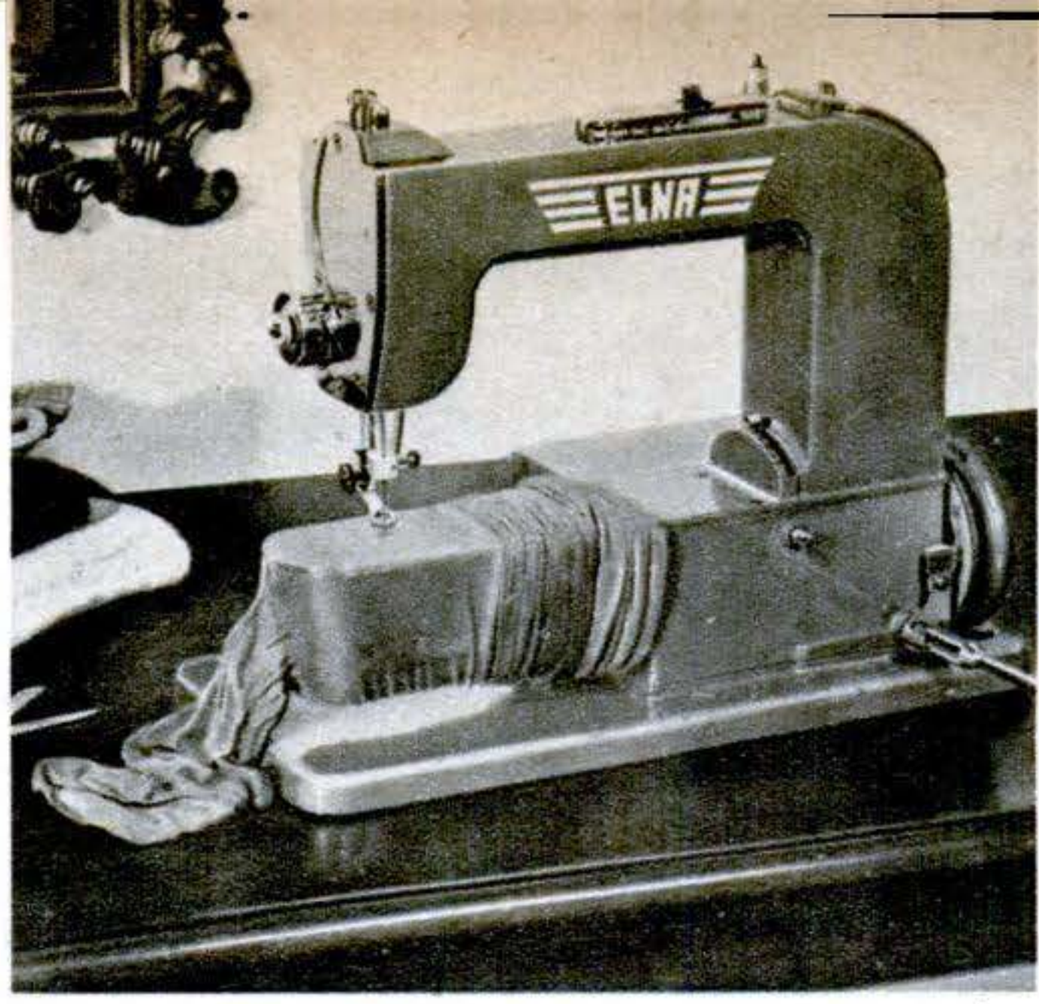
Powder Smothers Gasoline Fire

ROARING flames from a tub of gasoline are smothered in seconds by swirling dust from this new Kidde fire extinguisher. Used against flammable-liquid and electrical fires, the gun is loaded with a dry chemical that won't pack or clog. Pulling a trigger pressurizes the powder chamber with carbon dioxide from a side cylinder. Simultaneously, a valve in the chamber top opens, discharging fine powder through hose and nozzle. The stream carries 20 feet to the base of an intense fire despite upward hot-air currents.



Machine Makes Big Paper Bags

THIS outsize paper bag, 5 ft. deep and 24 ft. around, folds into the long strip, only 6 in. wide, shown same scale in the inset photo. Once a costly hand job, making such bags is now done quickly by a machine developed by Sherman Paper Products, of Newton Upper Falls, Mass. Its special trick is the accordion pleating that enables a bag to be snapped open to its full dimensions. The bags are used mostly to protect furniture, caskets, and large appliances from dust during shipment.



Light Machine Sews and Darns

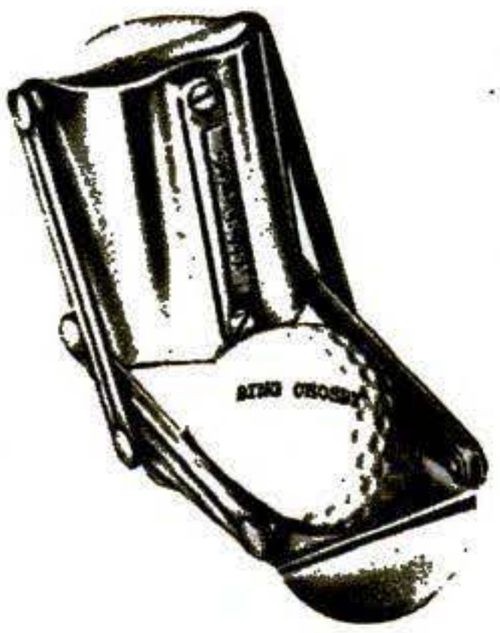
HERE'S a very light, portable, electric sewing machine that can even darn stockings. Slipped over a free arm resembling an ironing sleeveboard, as shown above, they are held firm without cumbersome attachments. For flat work, the carrying case fits around the arm to form a table. Swiss-made, the machine has just been introduced in the U.S. by the Elna Corp., of New York. It weighs 14½ lb., is powered by an AC-DC motor controlled by a knee lever, and has several interchangeable sewing feet for a variety of jobs.

New Thread Won't Ravel

A NEW way to make thread by welding the fibers side by side, instead of twisting them together, produces a one-piece strand said not to kink, snarl, split, or ravel. This magnified view compares the nylon Monocord® (right) with twisted thread. The secret process is reported to work with almost any fiber.

Pocket Press Marks Golf Balls

THIS golf-ball marker, small enough to carry in your pocket, can print any name up to 15 letters. Three complete sets of movable type from A to Z come with the press. A container with enough indelible ink for hundreds of balls screws into the back. Made of heat-treated aluminum alloy by Healthways of Hollywood, the new marker sells for $3.95.



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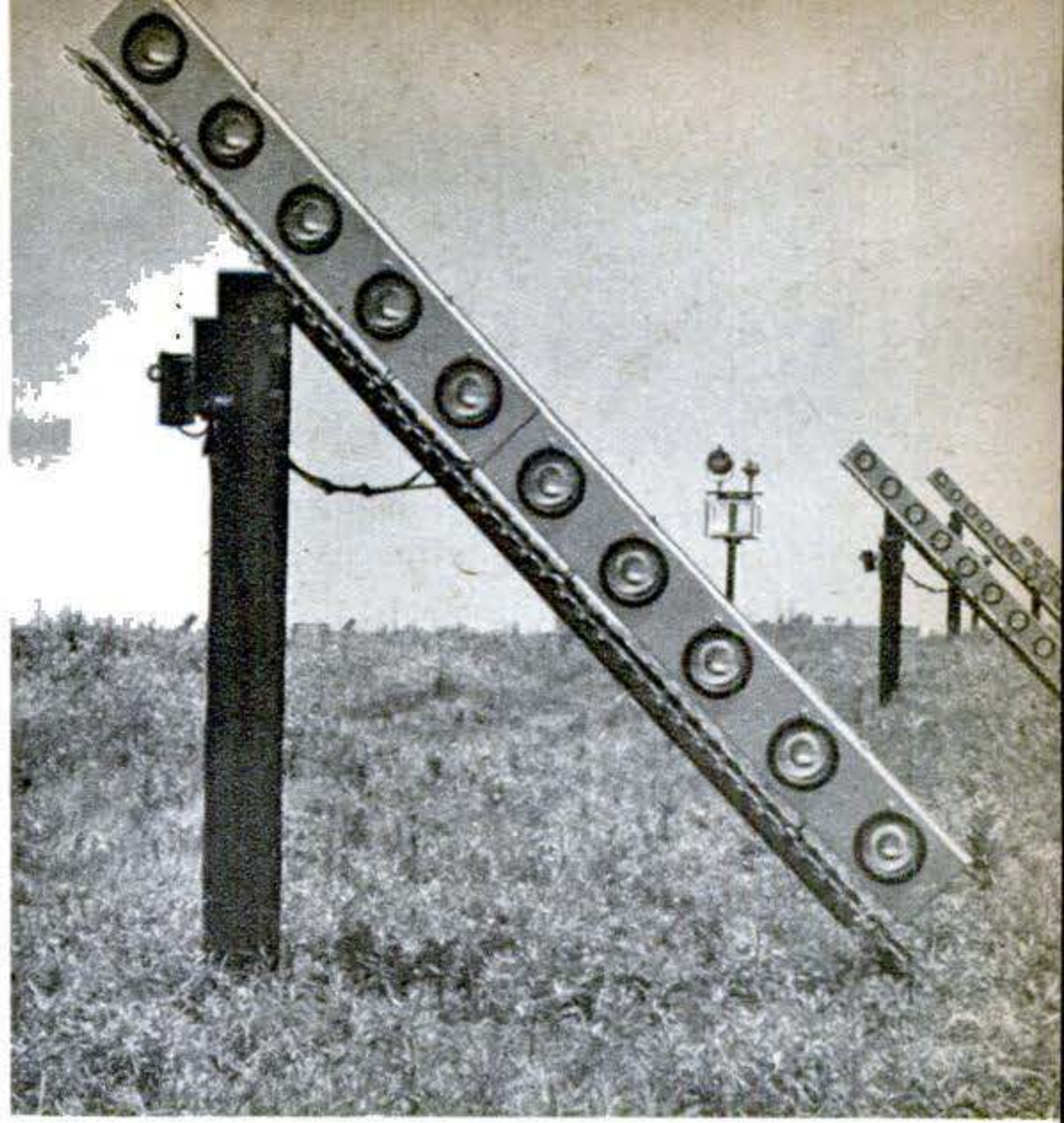
Slope Lights "Funnel" Planes In



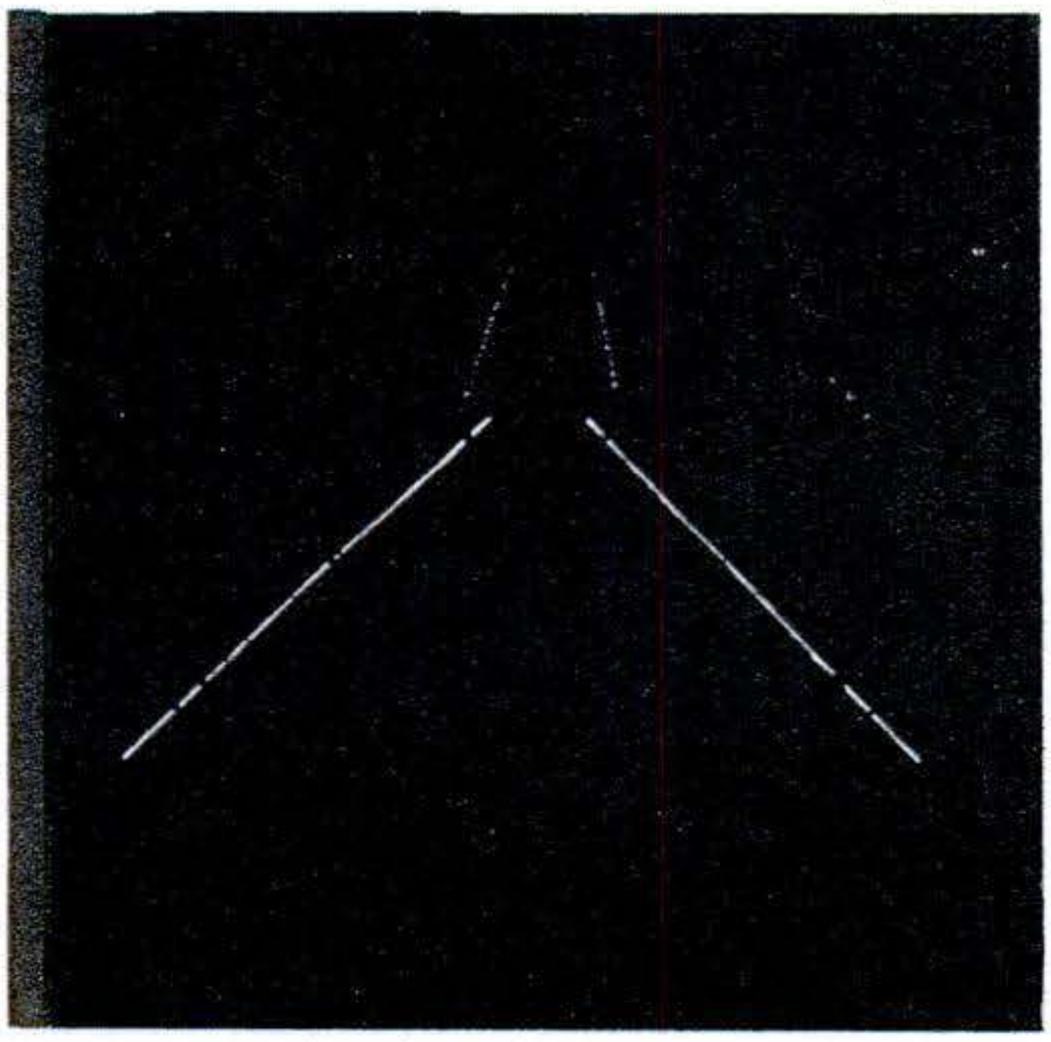
This sloping bank of 10 ordinary automobile headlights is set in a section of war-surplus runway matting. New version, improved since this Indianapolis system, uses 14 sealed-beam lamps.

COMING down through a fog on instruments, a pilot needs visual guidance during the last few vital seconds that may mean the difference between a safe landing and a crash. A new lighting system developed by the Civil Aeronautics Administration now gives him that last-minute assist. And it does so without his even needing to contact the control tower.

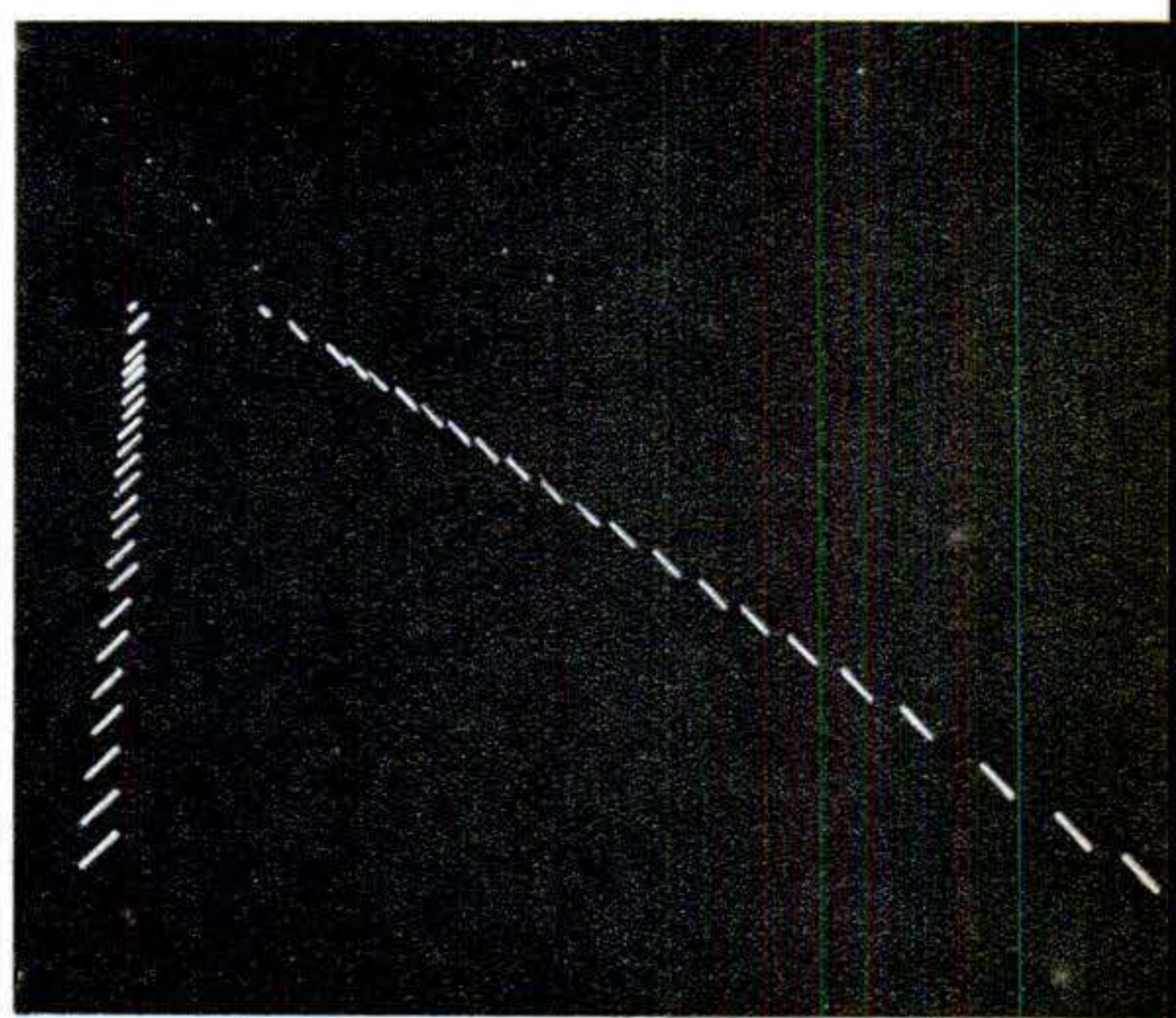
Using this new "slope-line" system, the pilot slips into fog-shrouded runways through a funnel of lights that stand ready not only to tell him when he is off the proper glide path but to show him how to get back on. The funnel is formed by two fixed rows of 30 sloping light units set about 100 feet apart. The rows converge as they approach the runway, forming a V that channels the plane in safely.

If the pilot is on the proper glide path, the two rows of beacons appear as two continuous strips of light. If he is off to one side, or too low or too high, he sees each row broken into separate bars of light. The relative positions of these bars tell him which way to fly to correct his error and get on course.

Each light unit consists of a bank of 14 sealed-beam lamps fastened about a foot apart on a strip of steel. These units are fixed to upright posts to form a 45° angle with the ground. The system has been successfully tested at the fogbound Landing Aids Station, at Arcata, Calif., using airplane landing lights of 500 watts, and at Indianapolis with sealed-beam automobile headlights.



Here's how the slope-line lights look to pilot when he's on course and in the approach glide path. He needs only to maintain his present direction into the funnel to reach the runway.



This is what a pilot sees when he's off course to the left. Note how each bar in the left-hand row seems to point to the right, telling him which way to fly to get back on proper course.

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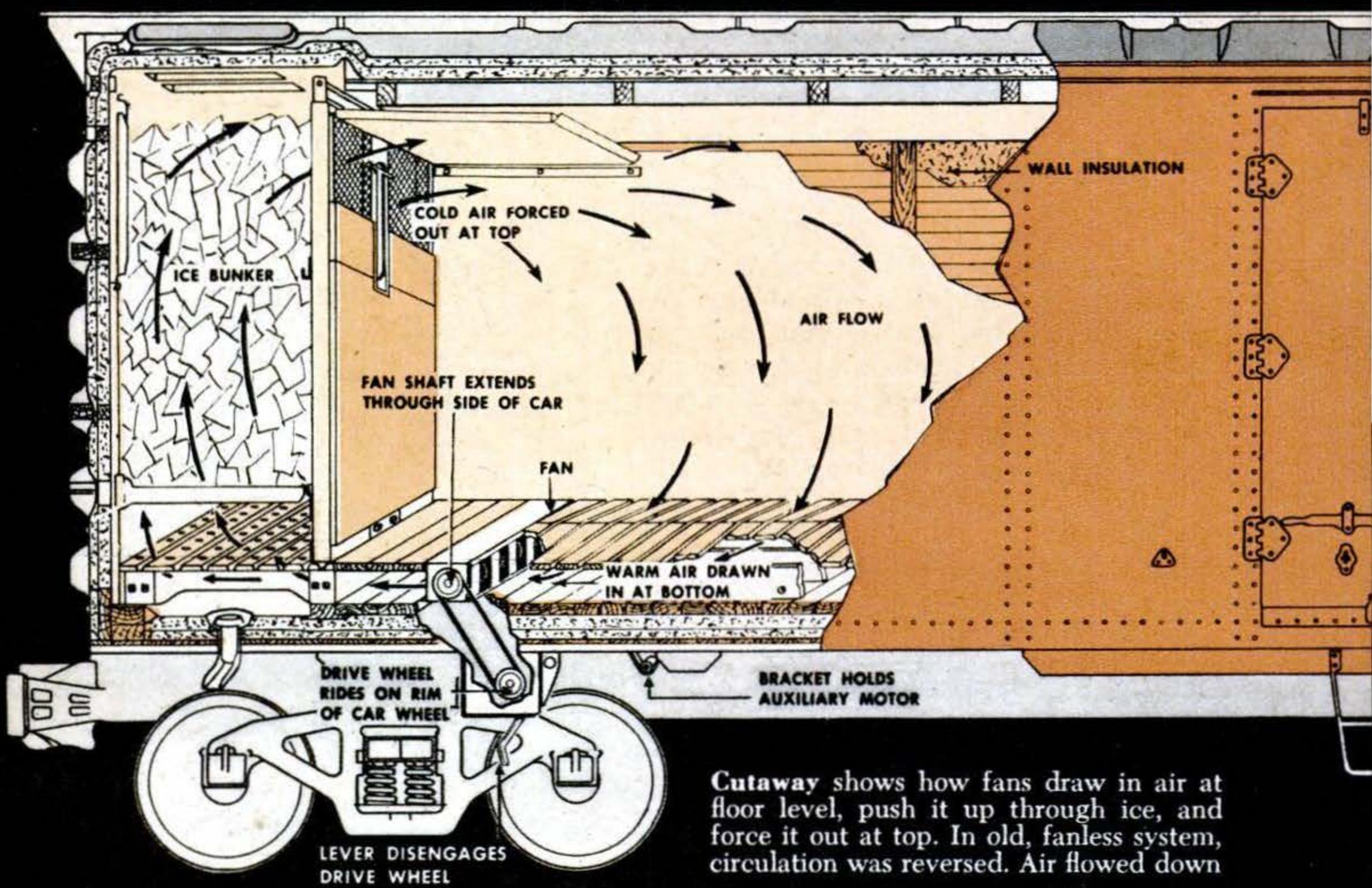
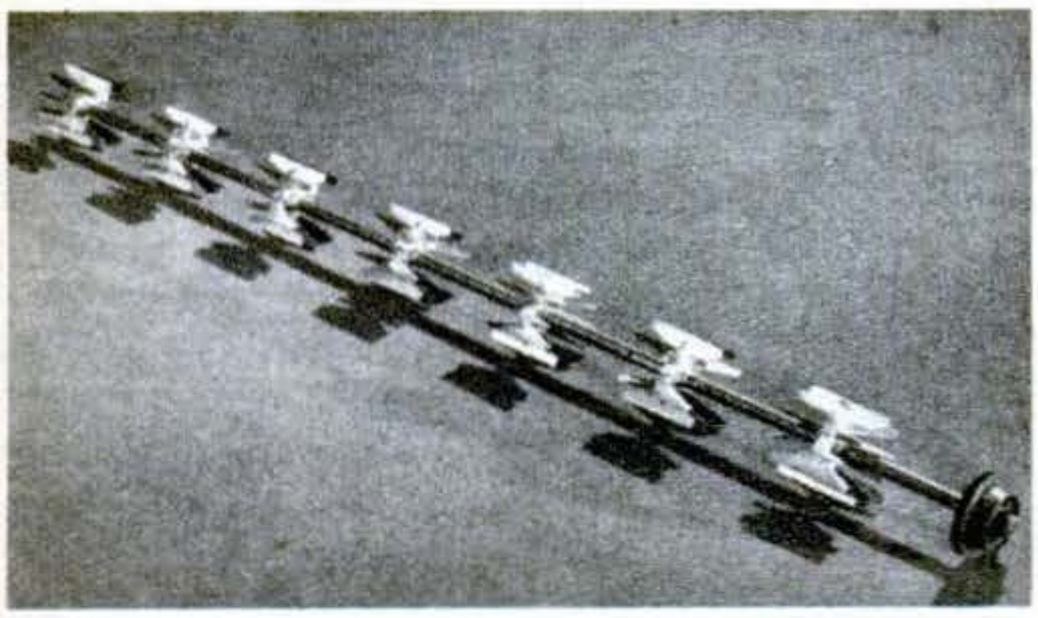


Cutaway shows how fans draw in air at floor level, push it up through ice, and force it out at top. In old, fanless system, circulation was reversed. Air flowed down

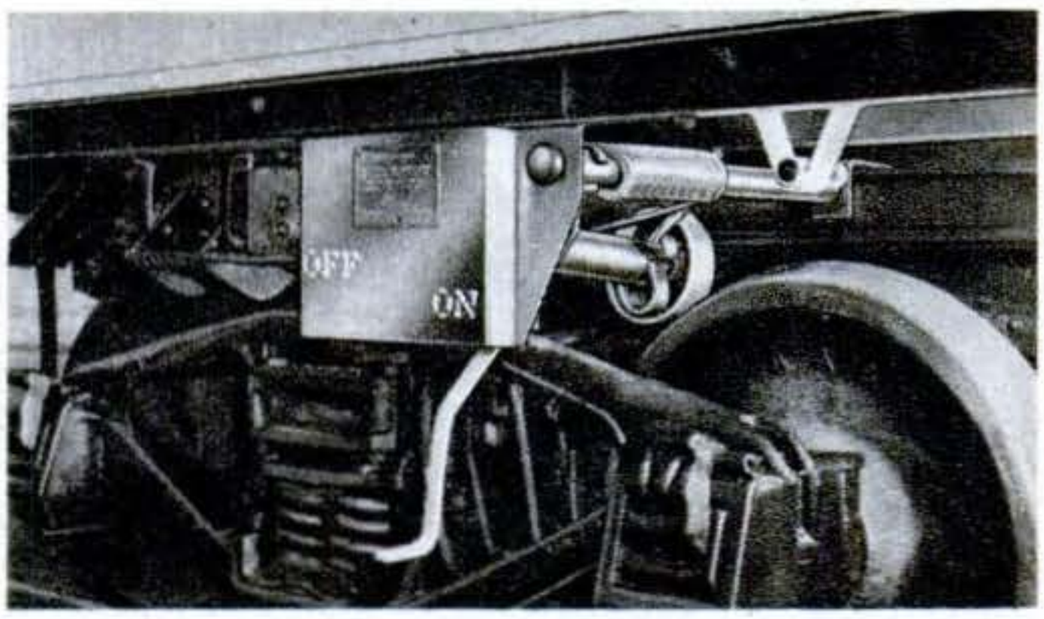
Reefer Fans Blow Hot or Cold

YOU may think it silly to put fans in a refrigerator, but it isn't silly when it comes to big railroad refrigerator cars. Because hot air rises and cold air settles, the ordinary reefer is always warmer at the top than at the bottom. Now two small fans provide a forced-air circulation that keeps the temperature even throughout the entire car.

The fans do another job. When sub-zero weather threatens to freeze food despite the car's insulation, small heaters replace the ice, and warm air is circulated. Made by Preco, Inc., the fans are already in 25,000 cars and are going into 600 others a month.



Fans' blades are series of tiny paddle wheels extending across each end of car on long shafts.



When car is moving, fans get power through small wheel riding on rim of one of car wheels.

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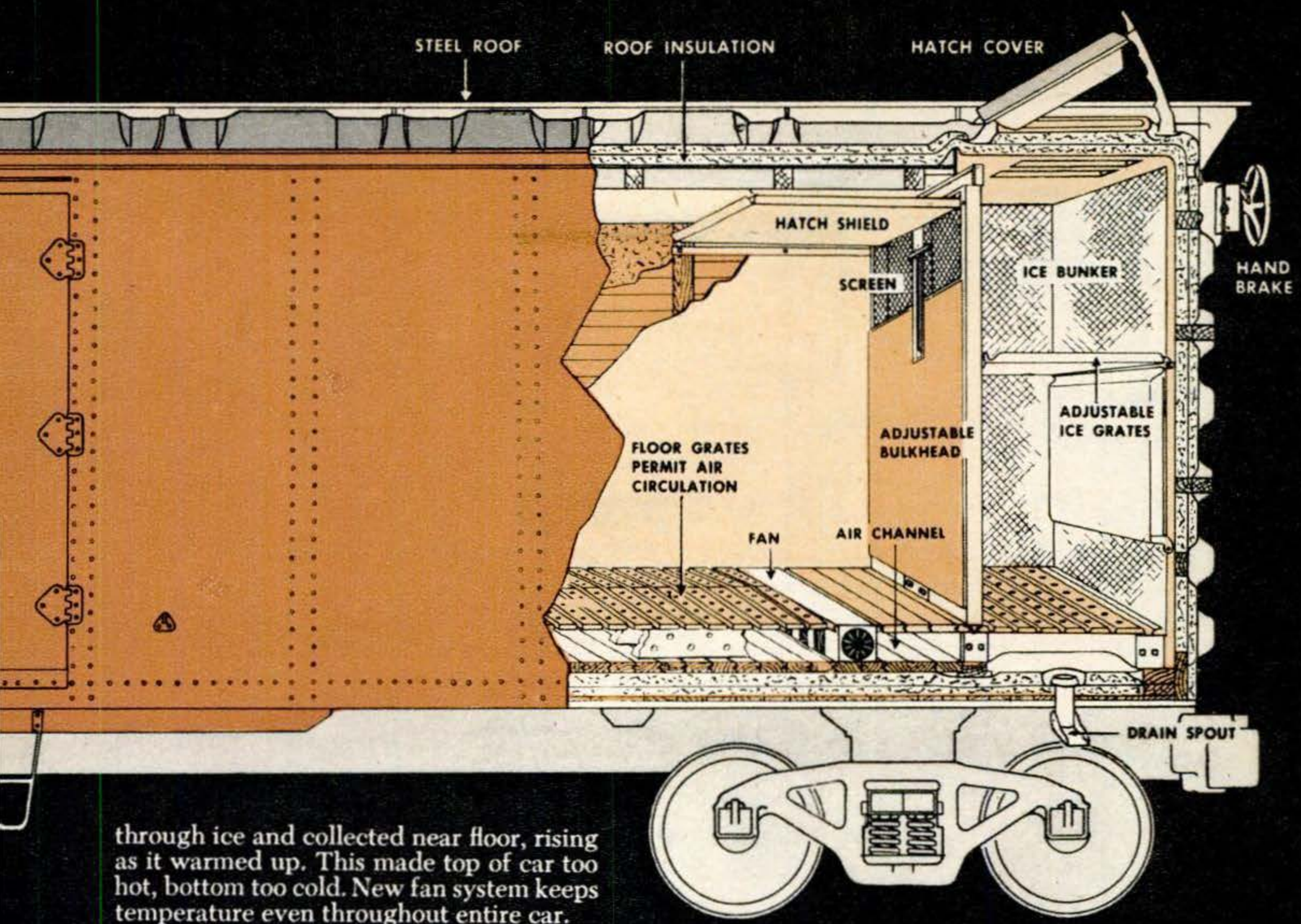
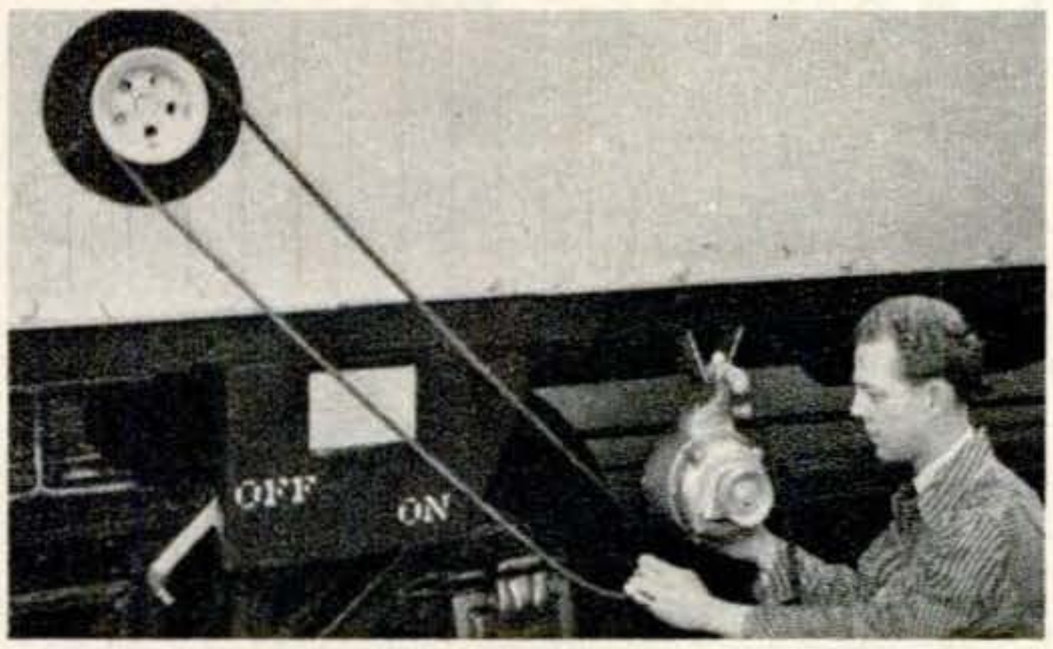
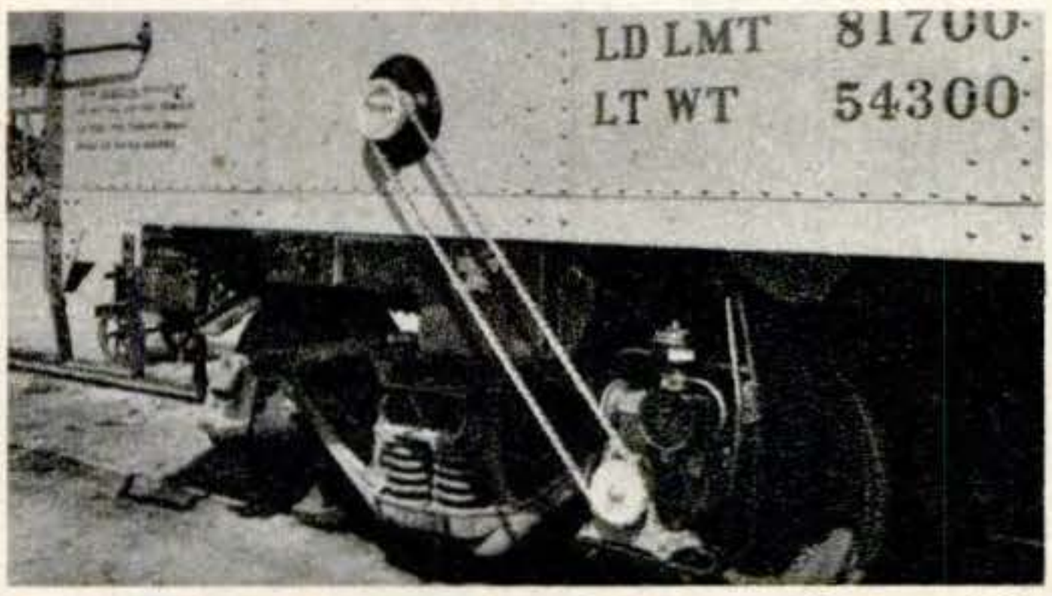


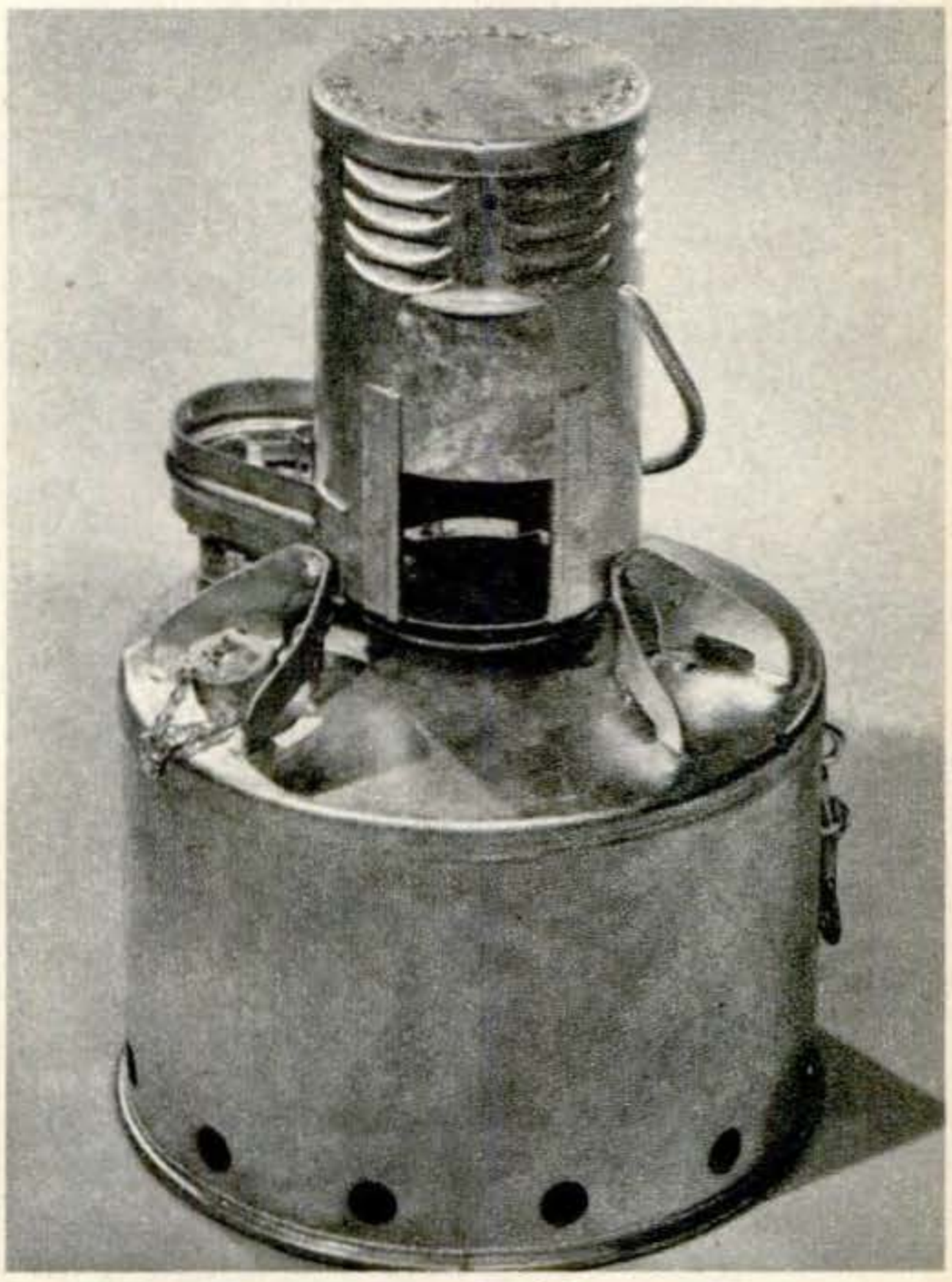
through ice and collected near floor, rising as it warmed up. This made top of car too hot, bottom too cold. New fan system keeps temperature even throughout entire car.



When car is stopped, electric motor is hooked on to keep fans going. Fan shaft sticks out car side.

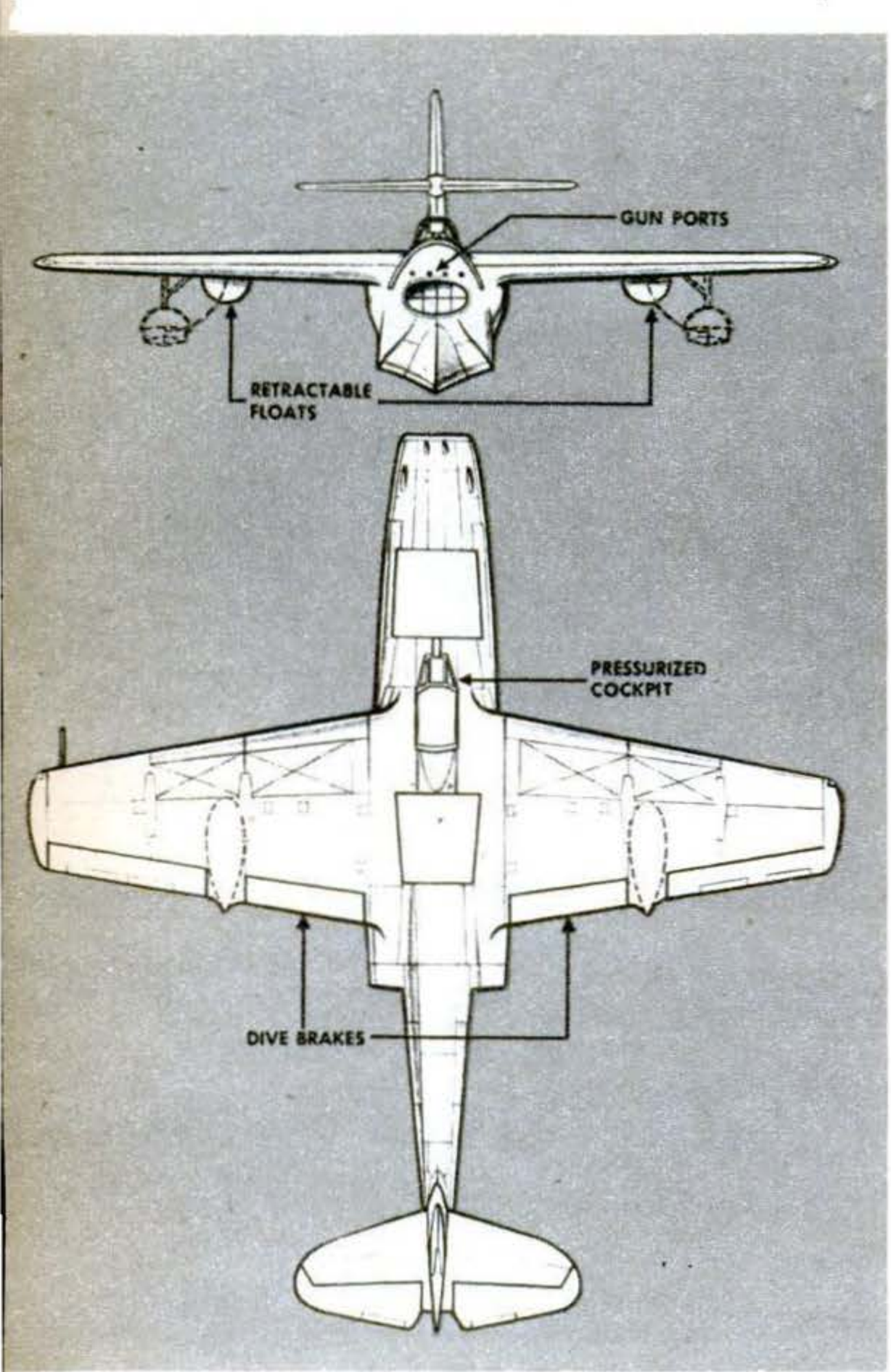


Where there is no electricity, small, portable gasoline engine can be hooked on in same way.



In cold weather, methanol-burning heaters replace ice in bunkers, keep food from freezing.

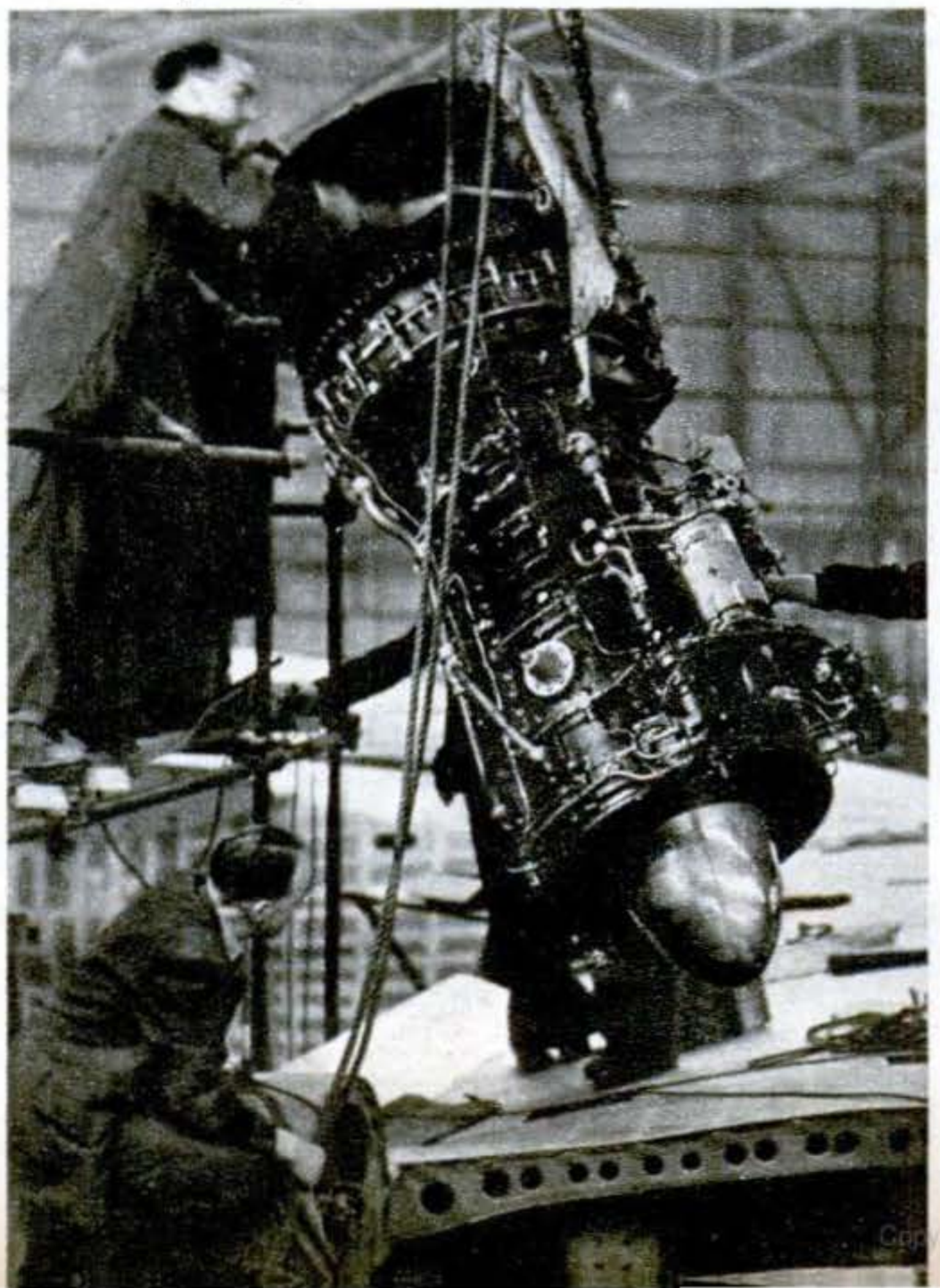
The hull of the S.R/A1 is a floating powerhouse from which protrudes a pair of jet pipes.



Drawings from *Flight*, of London, show how flying boat's landing floats retract into wings in flight. The new jet plane is 50 feet long and has a wing span of 46 feet; weight is 16,255 pounds.

Jets Power First Fighter Flying Boat

Lowering turbojet engine—one of plane's two—into the hull through main hatch is a tricky job. A third prototype of the S.R/A1 has a more powerful Beryl engine rated at 3,850-lb. thrust.



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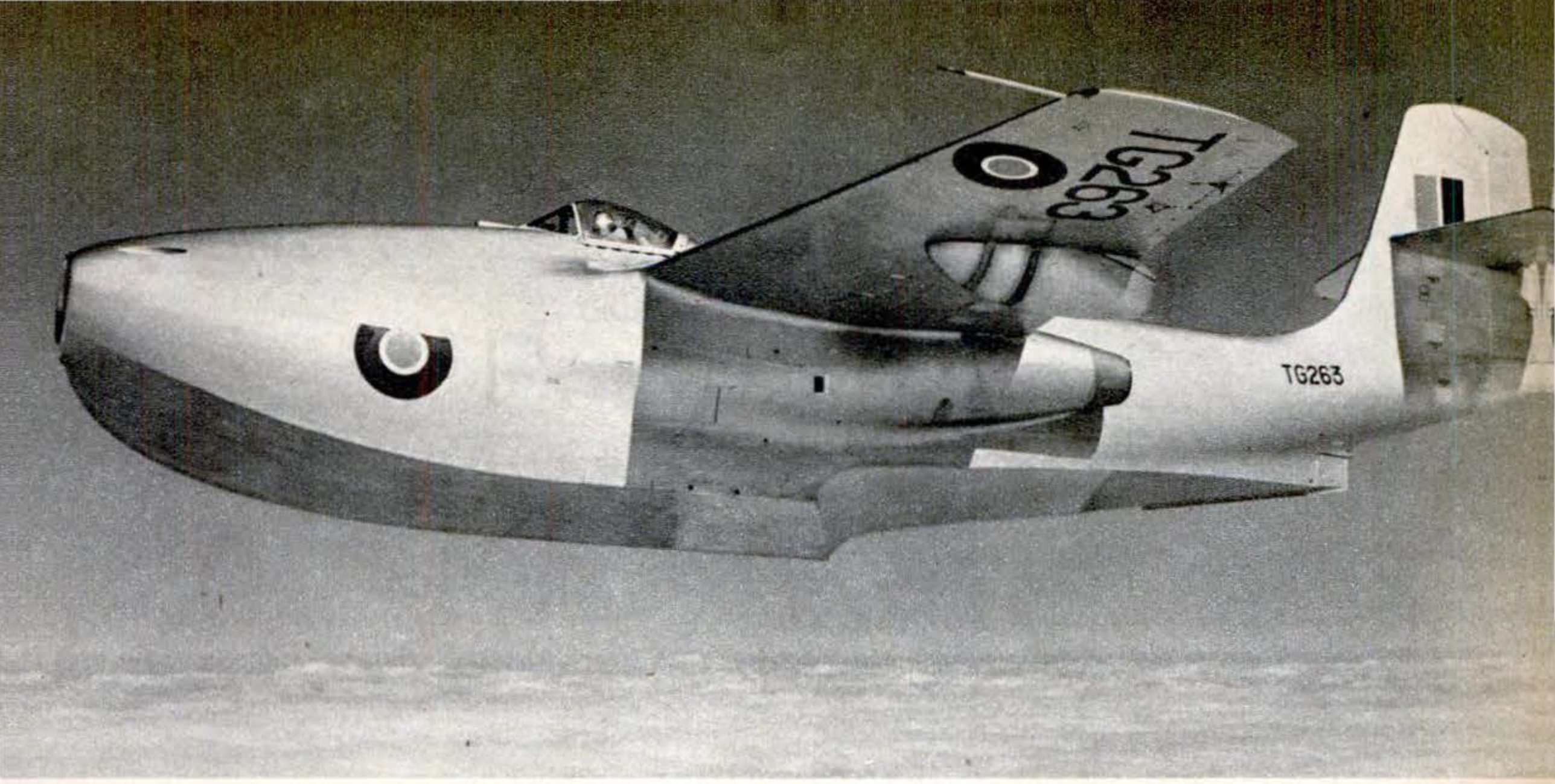


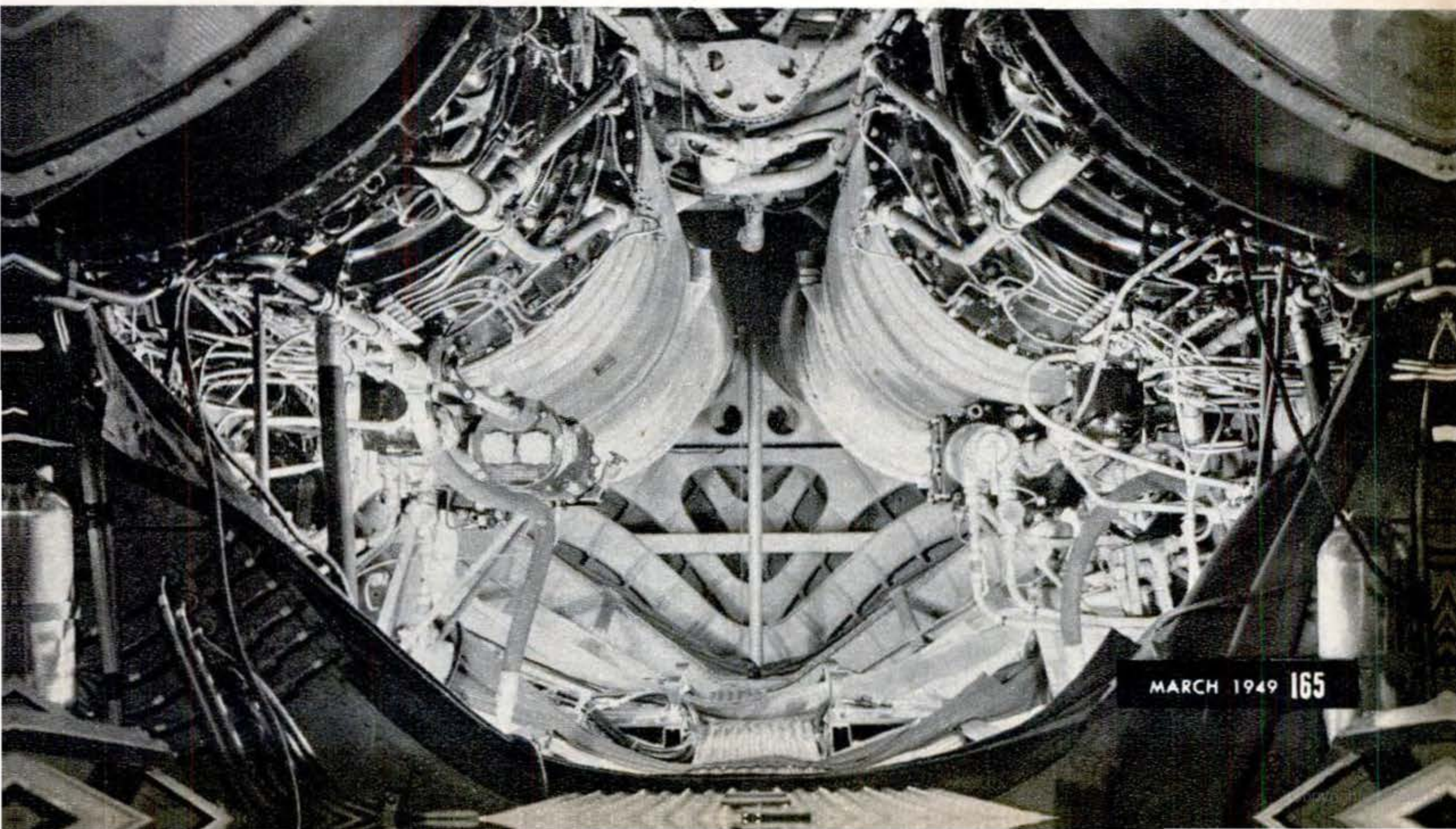
Jet power, speeding this sleek British flying boat at 500 m.p.h., puts it in the fighter class.

WITH any stretch of water an advanced fighter base, the advantage of a flying-boat fighter is obvious. But it took the power of jet propulsion to give such an aircraft speed and reality: the British Saunders-Roe, pictured above on water and in flight.

The S.R/A1 (PS, Oct. '47, p. 106) is a twin-jet, single-seat fighter flying boat mounting four 20-mm. cannon ahead of the cockpit and firing over the bow. The wings carry float-retracting mechanism, air brakes, dive-recovery brakes, and landing flaps. Already thoroughly flight-tested, the first two prototypes have twin Metrovick F. 2/4 turbojets, rated at 3,500-lb. thrust, in a hull engine room. The air intake for both engines is in the nose and has an extensible, power-operated snout to prevent entry of spray or water.

The pilot controls the boat from a pressurized cockpit at the top of the fuselage, sealed off from the hull. The engine room, however, could accommodate one or two engineers who would have access to the engines in flight. Speed is given as 500 m.p.h. END

This engine room, although hot and noisy, can accommodate one or two engineers. On 425 gallons of fuel, the plane can cruise for one hour, with 15 minutes of combat and a 10% reserve.



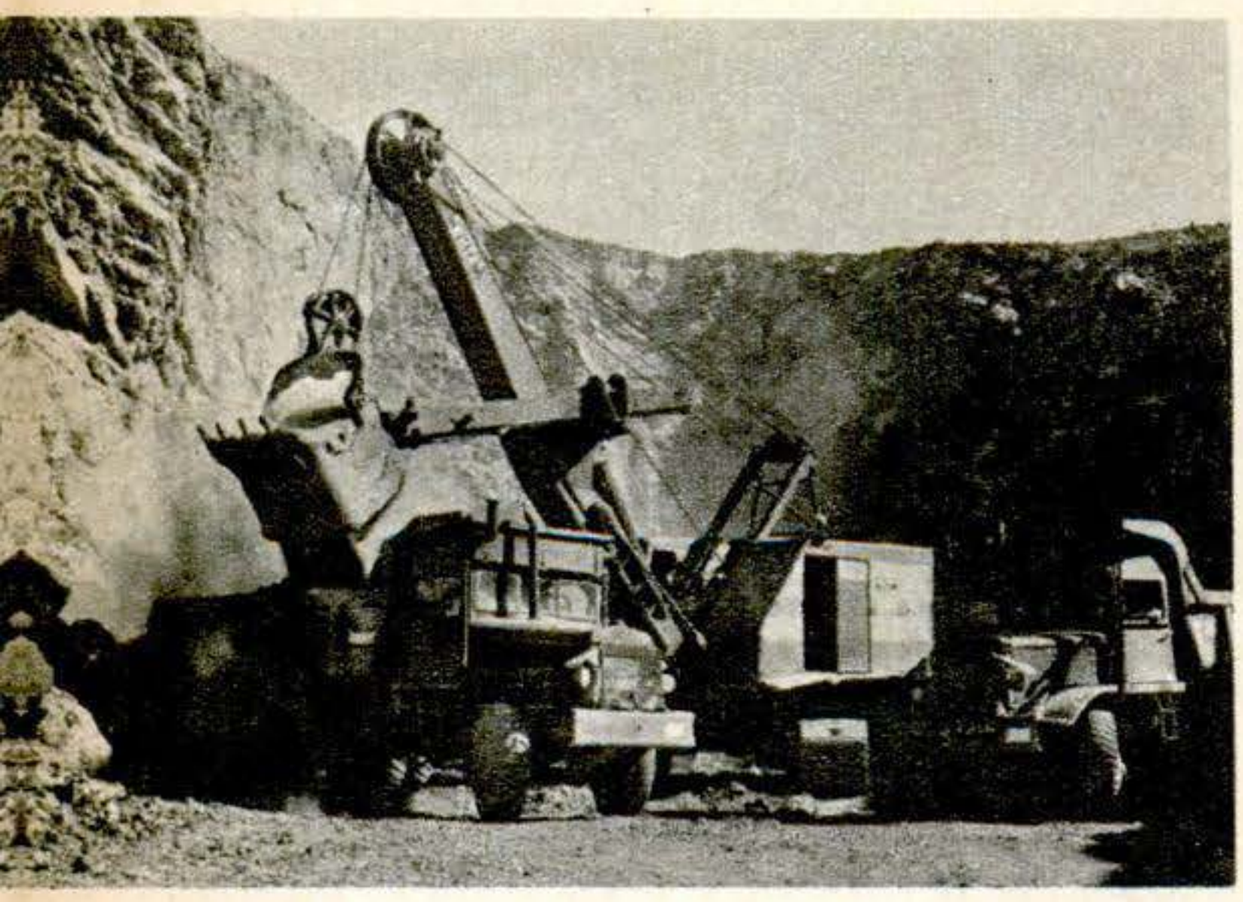
New RR Taps Rich Mine

INDUSTRIALIST Henry Kaiser faced a problem: lack of a rail line across a third of the 150 miles of rugged Southern California terrain from his new iron mine to his new steel mill. Now he has solved it, in his own expansive style, by bridging the gap with the first new railroad built in this country since 1926.

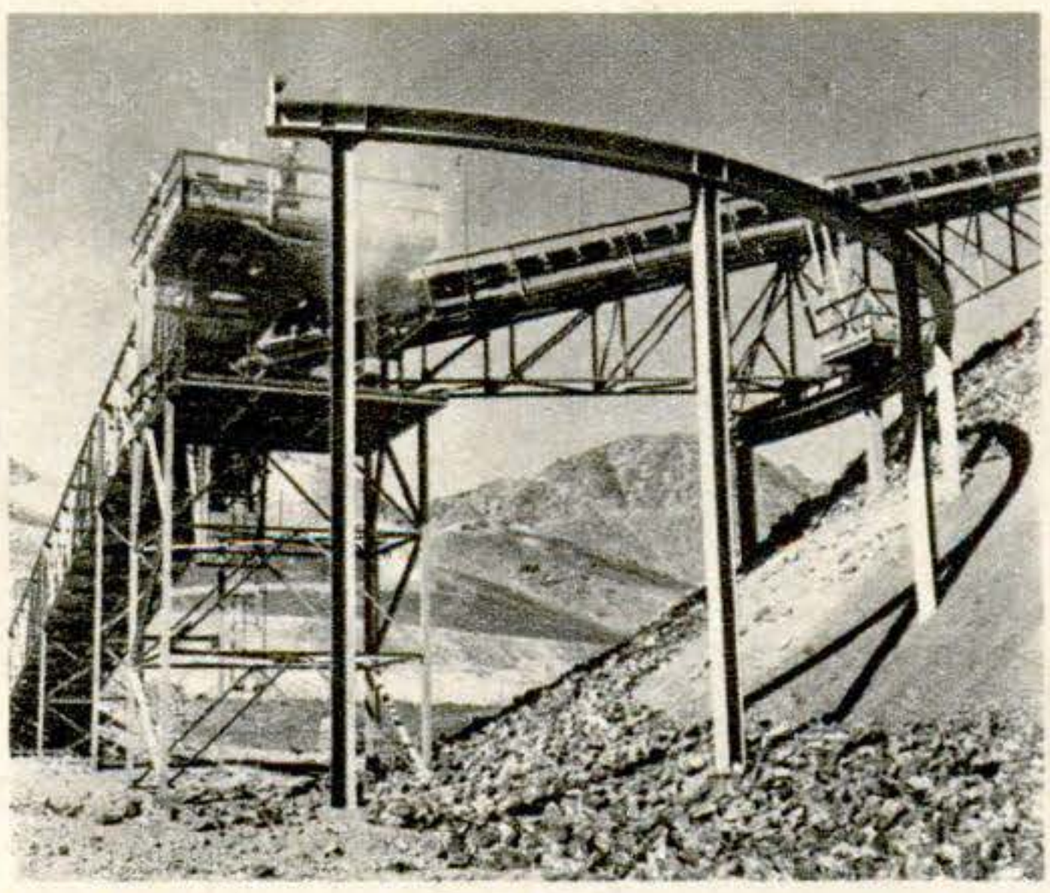
Opened late last year, Kaiser's private railroad carries 1,680 tons of ore a day from open pits in the Eagle Mountains, 1,372 feet above sea level, to the town of Ferrum, 190 feet below sea level, in the Imperial Valley. There this spur line connects with the Southern Pacific for the rest of the trip to the Kaiser steel plant at Fontana.

The new railroad taps a surface deposit of high-grade ore that a survey by the U. S. Bureau of Mines shows will support mining at the present rate of nearly 2,000 tons a day for the next 20 years.

To get there, 52 miles of standard-gauge track—the longest stretch privately built in the U.S. since 1918—span the All-American canal and turbulent Salt Creek, worm up mountain valleys, and cut across the wartime training ground of General Patton's armored divisions. Construction problems included keeping men working in desert temperatures as high as 125° and designing trestles—one 556 feet long—capable of standing up against devastating flash floods.

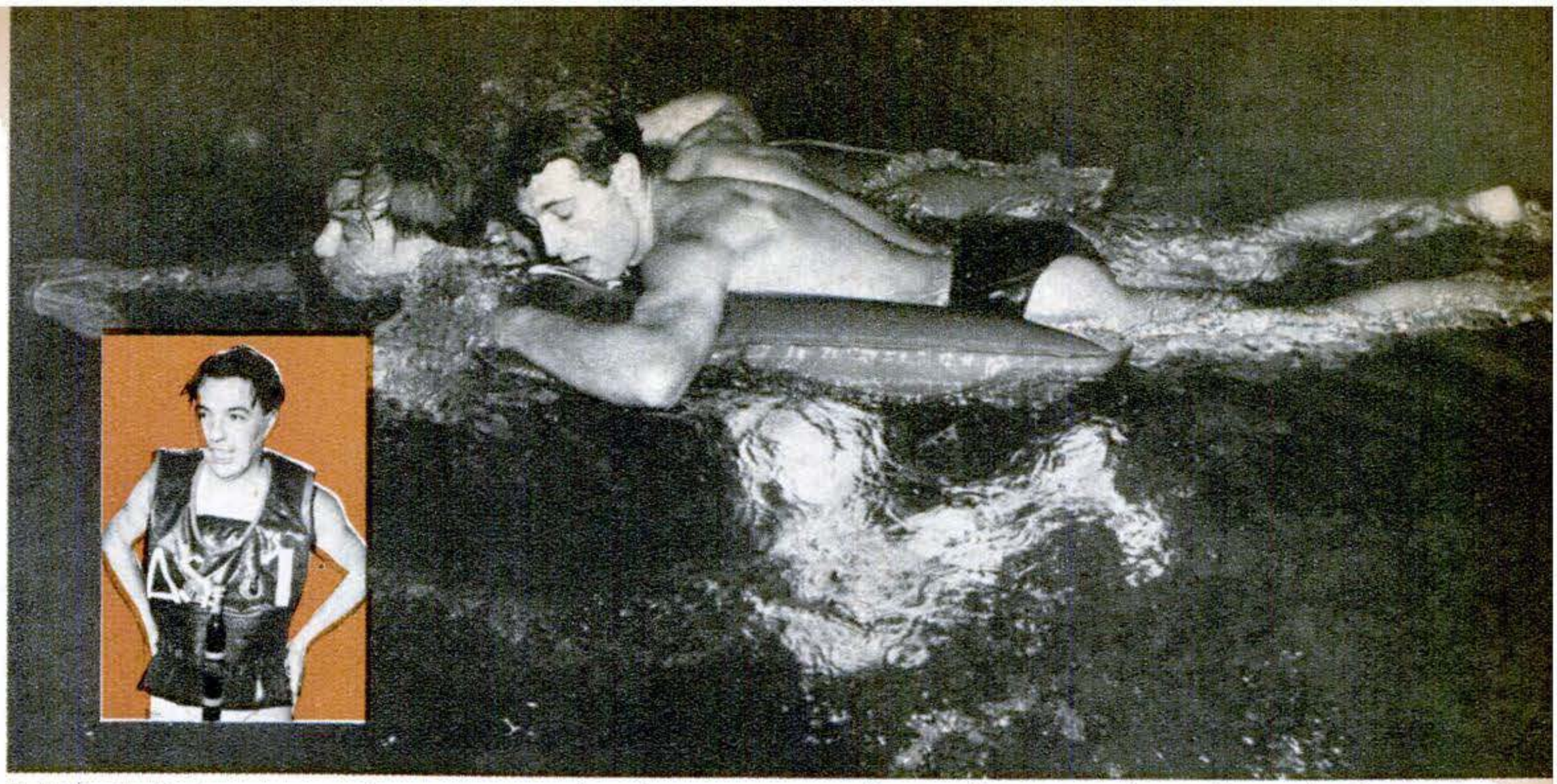


Diesel-powered shovel loads dump trucks with 5-ton mouthfuls of high-grade iron ore blasted loose from surface vein in California's Eagle Mountains. Trucks make short hauls to a crusher.



Crushed ore is stockpiled by a conveyer whose hinged snout can swing in a semicircle on an arced track to distribute the ore evenly over this huge pile near the new railhead in the mountains.

Kaiser train (below) is loaded with Kaiser ore for Kaiser mill. Conveyer carries ore from bottom of stockpile and dumps 60 tons into each of 28 cars pulled by a big Diesel-electric locomotive.



Self-inflating pneumatic mattress of nylon, carried by rescuer (inset) to exhausted swimmer, supports him as he is towed to safety. The long-wearing nylon fabric resists damage by salt water.

Nylon Plays New Roles

HAVE you tried out a nylon carpet on your floor, nylon strings for your ukulele or guitar, or a nylon-faced hammer in your home workshop? Photos on this and the next two pages show these and a dozen more recent applications of Du Pont's synthetic product of coal, air, and water.

Nylon has proved one of the most versatile of modern materials since its introduction a decade ago, first for toothbrush bristles and then in stockings. Its wiry strength, rubber-like elasticity, and resistance to fraying, soiling, and damage from the elements have led to nylon tents, sails, flags, tire cords, rugs, draperies, upholstery, and garments of every description. But fabrics are not the only materials in which its desirable qualities can be used for improved products.

Obtained in translucent ivory flakes and melted for use, nylon is a true plastic. Besides being spun into filaments for textiles, it may be molded into rods, sheets, or solid objects of any shape. Thus it now yields drinking glasses and nursing-bottle funnels that can be sterilized by boiling water without harm, machine bearings that need no lubrication, translucent armor that guards steel cables from rust, and buttons you don't have to sew on.

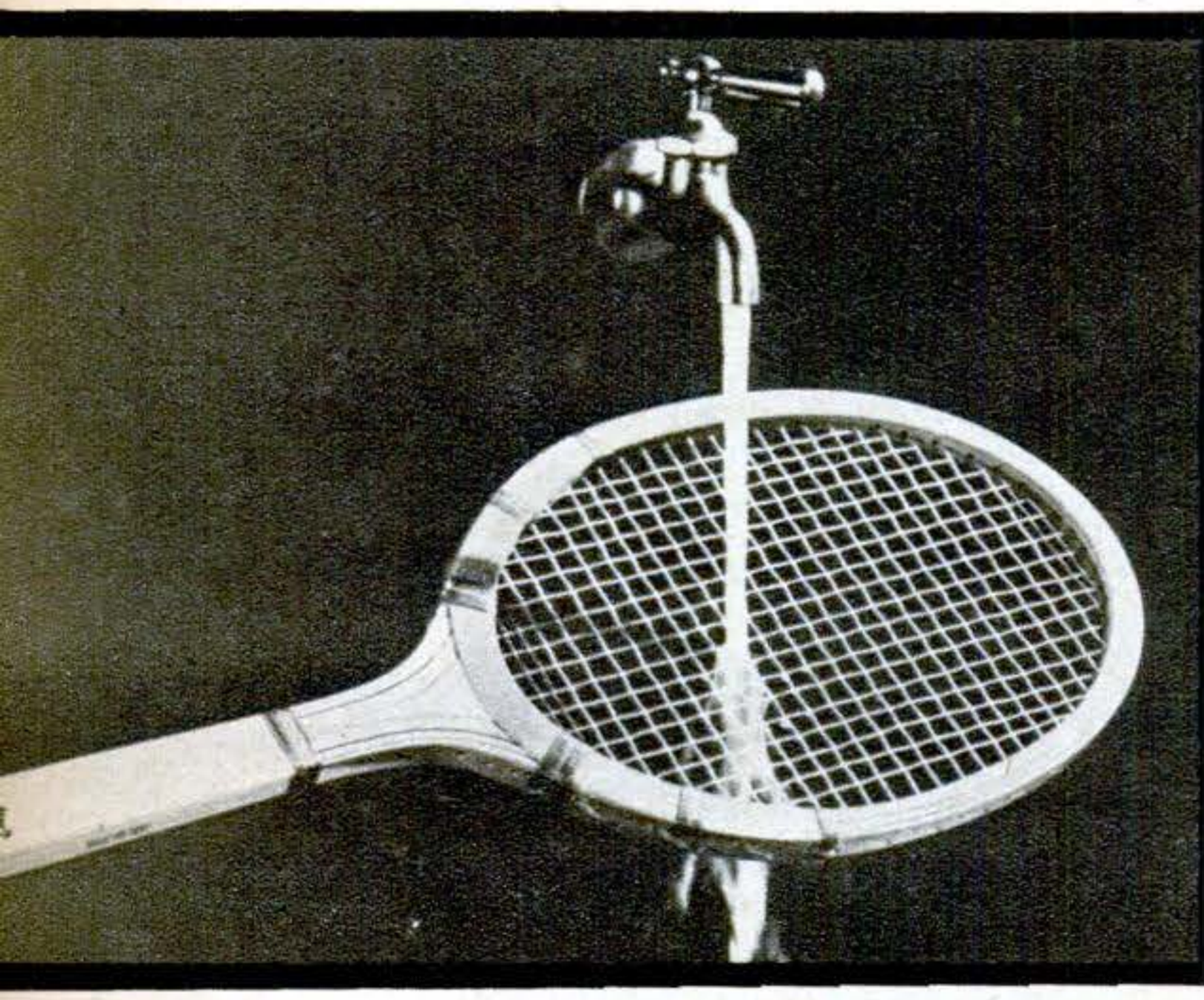
Plastic machine parts now are molded of solid nylon. White block at end of the spool of yarn (below), which makes 15,000 revolutions a minute in textile machine, is oil-less nylon bearing.

Nursing-bottle funnel of nylon plastic for preparing baby's formula, now available at five-and-ten-cent stores, is rustless, will not break, and can be sterilized in boiling water without losing shape.

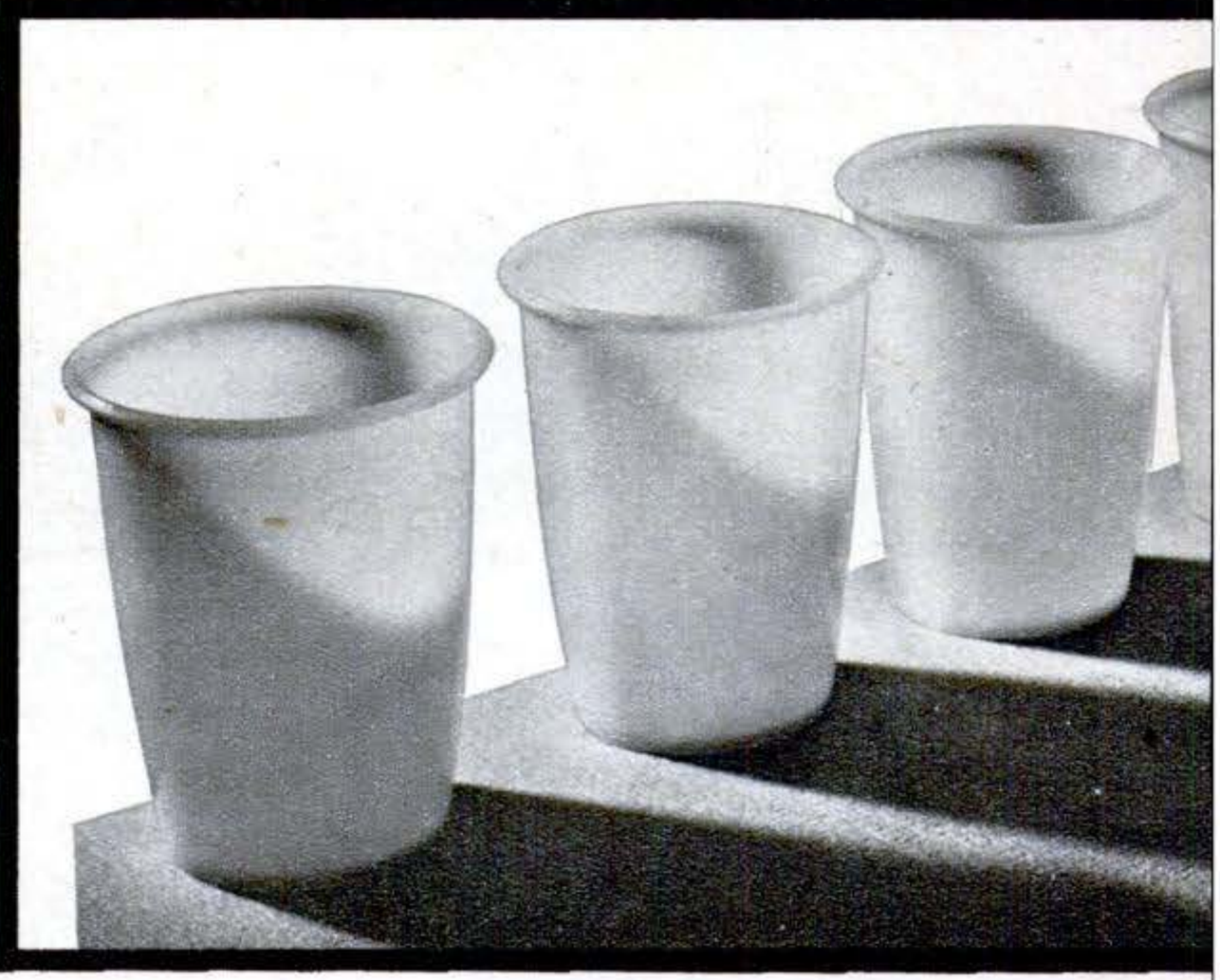
Copyrighted material

Metal worker's hammer with resilient, durable nylon faces will not mar soft metals. Tested by pounding it with sharp instrument, nylon lasted 2½ times as long as the next best material tried.

Army's new stove-heated tent for Arctic, on exhibition above, applies ability of lightweight nylon to shed the snow and keep heat in. The tent weights only half as much as former types.



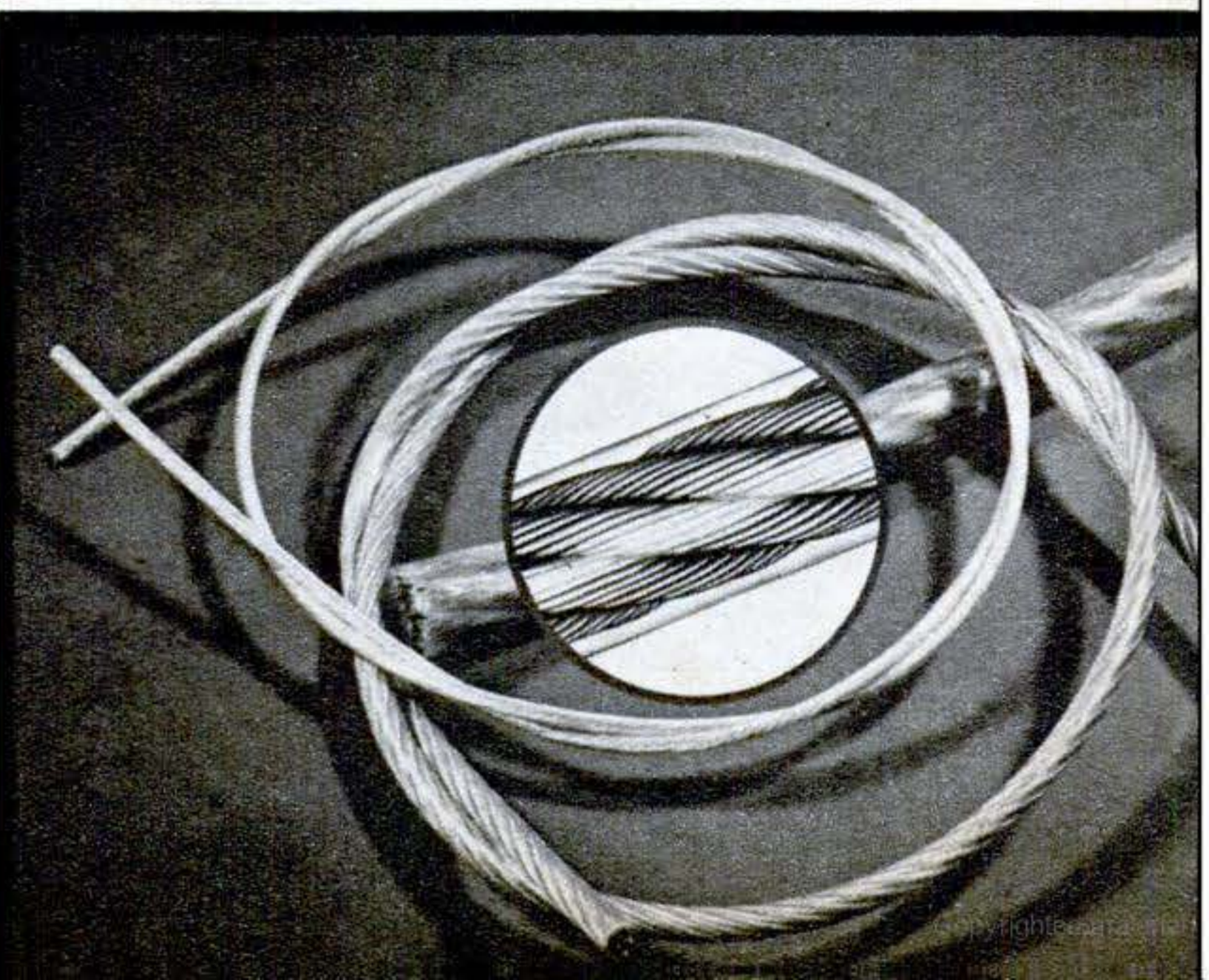
Running water can't harm the strings of this tennis racket, for they're made of waterproof nylon. Tough and elastic, the solid strings have no strands to fray, and defy breakage in use.

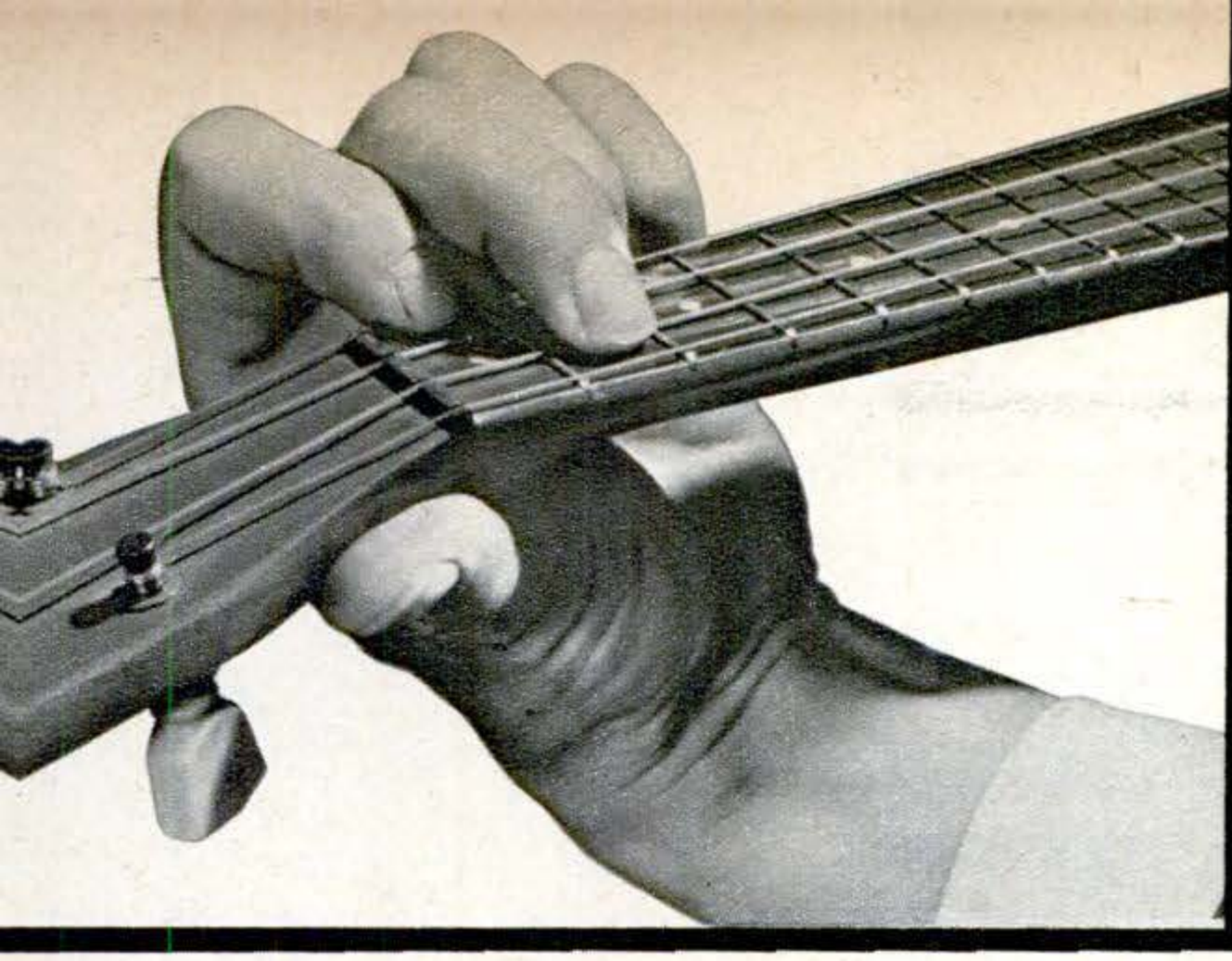


Tumblers of ivory nylon plastic, which don't break when they are dropped and which will withstand the heat of boiling water, are recommended for children and for use in hospitals.

Motorcycle is protected by sturdy waterproof cover of nylon (below), especially suited to purpose by high strength and resistance to tearing. Its light weight makes the cover easy to handle.

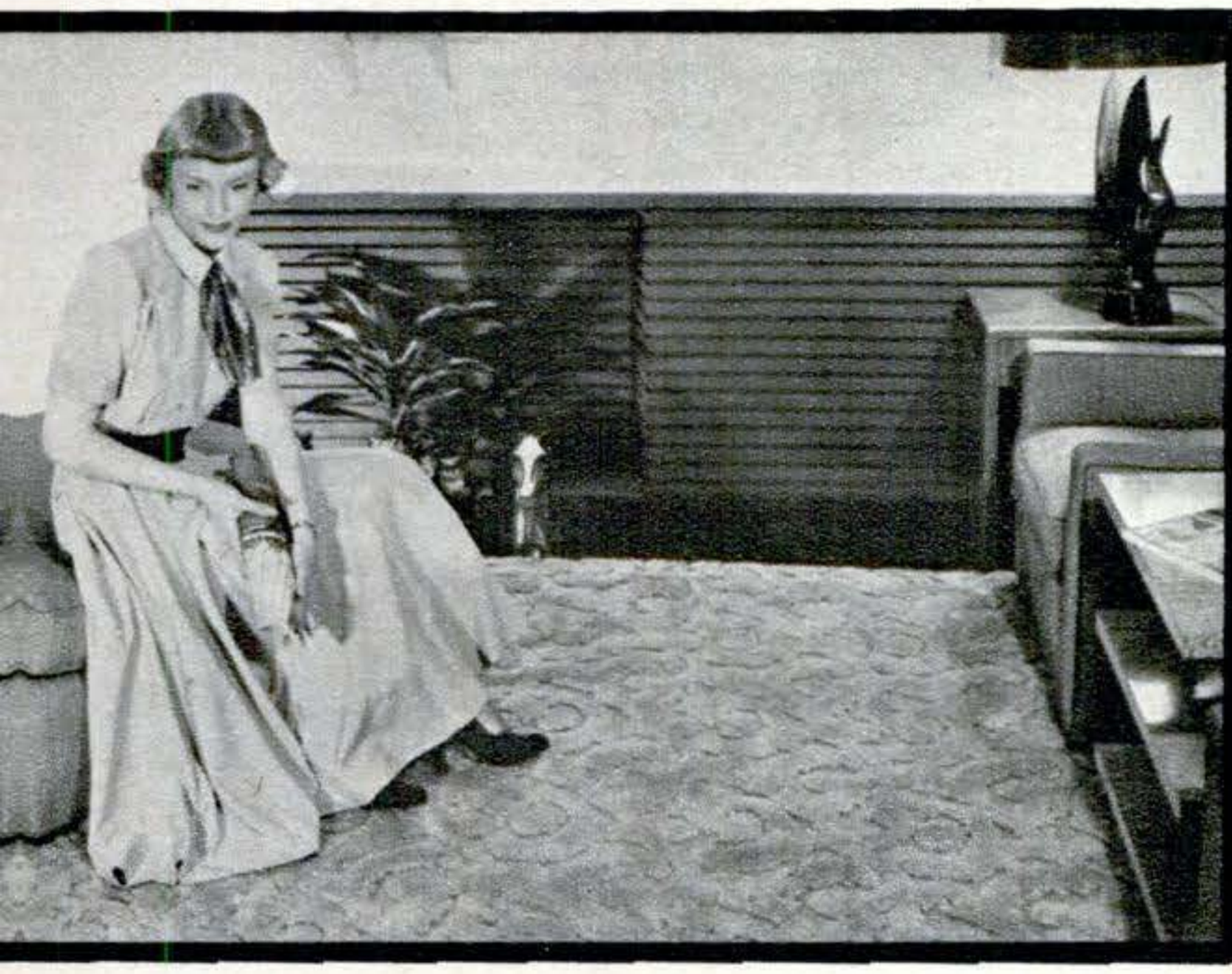
Dog leashes, sash cords, and elevator cables are uses foreseen for Wirelon®, wire rope with solid translucent-nylon sheath that prevents rust and kinking and thus makes it wear longer.



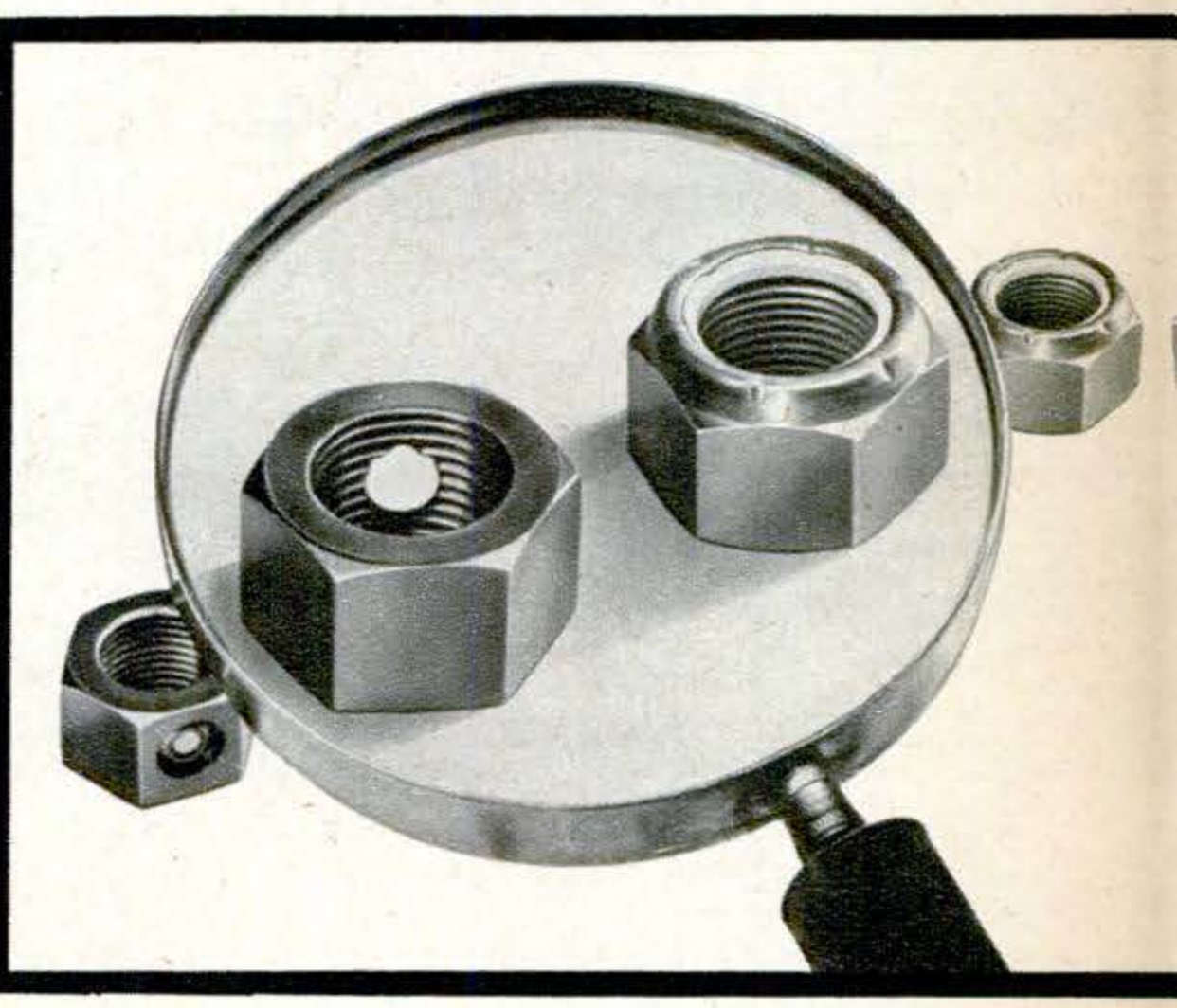


Nylon strings give superior tone and long life on ukulele, guitar, and harp. They are too smooth for instruments that are played with a bow, but nylon may replace horse hair in violin bows.

Drawers glide silently and smoothly on nylon rollers, which eliminate metal-to-metal contact and need no lubrication, in new kitchen cabinet, above, made by Geneva Modern Kitchens, Inc.



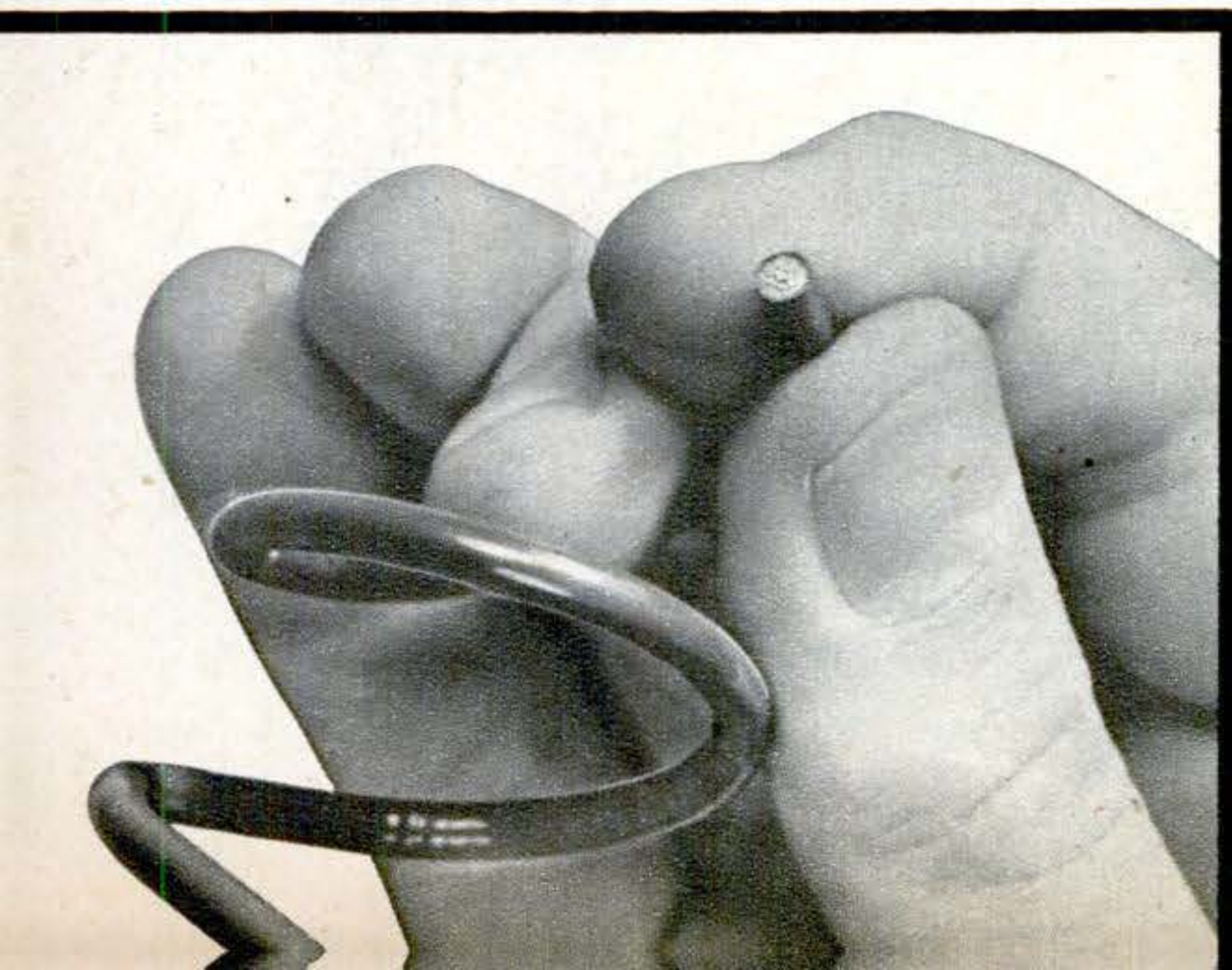
Luxurious carpet for home, recently shown for first time, cushions step with resilience of deep all-nylon pile. Mixtures of wool and nylon, less expensive, are also being used for carpets.

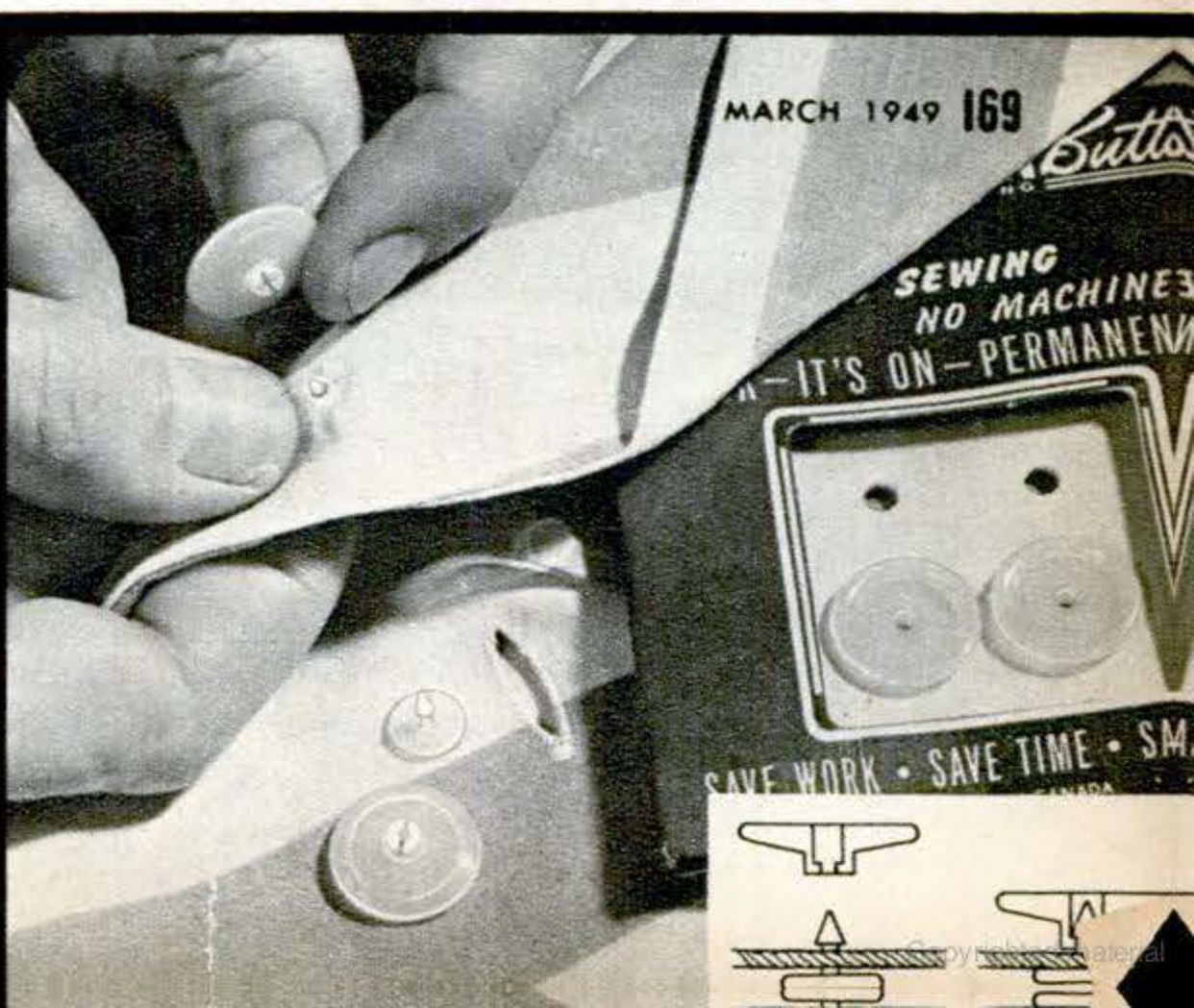


Self-locking nuts, now available, contain a button or ring of nylon bonded to the metal. The resilient plastic grips the bolt threads so tightly that the nut can't work loose and come off.

Smallest electric wire ever developed for homes and buildings, a U. S. Rubber Co. product, enables conduit to carry more conductors. Hard shell of nylon protects the rubber insulation.

Handy for bachelors, Butt-On® button replaces missing one without use of needle or thread. Its two nylon parts snap together. They withstand laundering and are unaffected by heat of an iron.

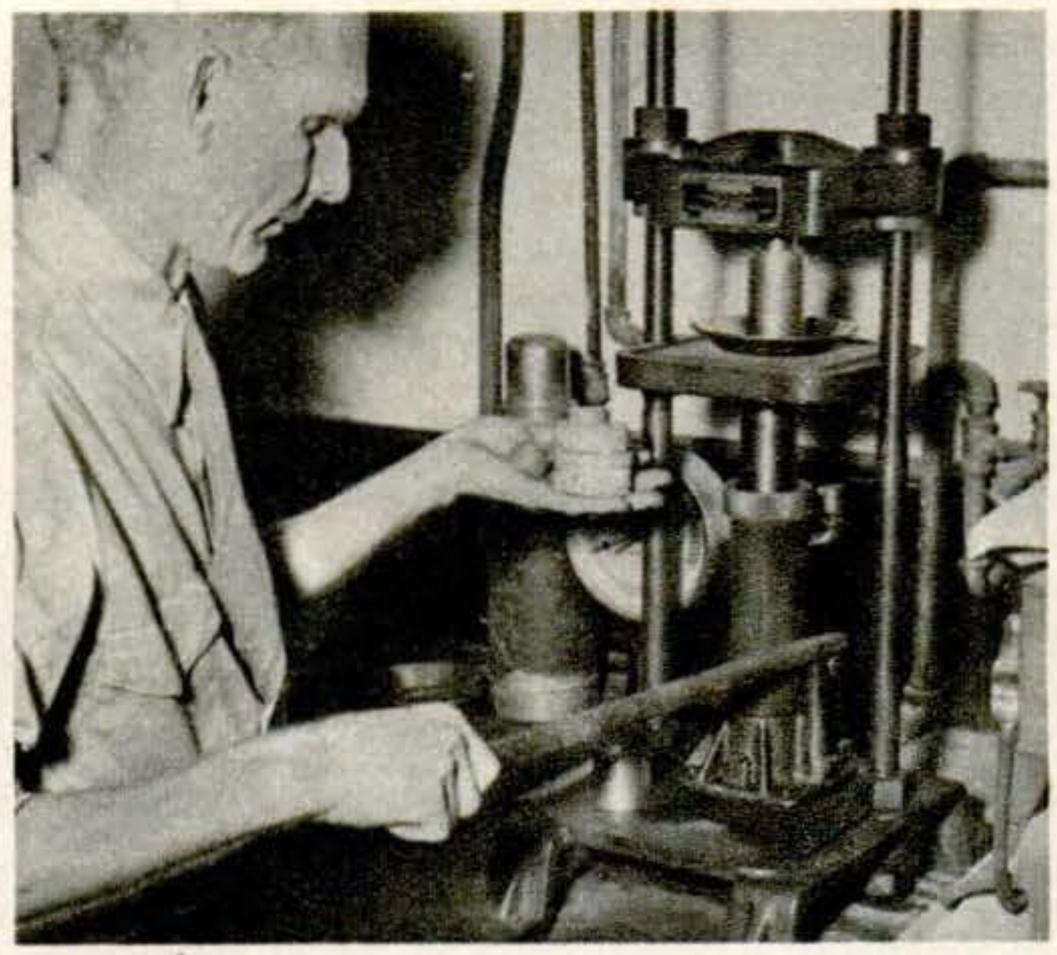




Atom Tracers Tell How Trees Tick

Wearing rubber gloves, Dr. Hammar applies radioactive phosphorus with hypodermic syringe to root of tree in successful test of fertilizing by injection. Pecan trees near Albany, Ga., were "guinea pigs" for new technique, which may prove beneficial to other varieties of orchard trees.

Radioautograph of pecan-tree leaves, made on photo film in total darkness by telltale rays of radioactive phosphorus, shows fertilizer has reached them and become concentrated in their tips. Thin-sliced specimens of nuts and other parts of tree give similar long-exposure pictures.



Laboratory press, applying pressure of 12,000 pounds to square inch, compresses ground specimens of pecan roots, branches, leaves, and nuts into round wafers that Dr. Hammar holds in hand. These can then be subjected to delicate radioactivity tests with sensitive instruments.

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Tests with radioactive fertilizer point way to needle orchards into producing bigger, better, and cheaper crops.

SHOOTING fertilizer into trees with a needle, the way people take vitamin shots, may save countless tons of fertilizer yet yield more and better orchard crops.

That's the promise held out by the amazing results of the first use of radioactive tracers to study what happens inside trees, just as doctors now use such atomic-energy products in medical research.

In the pioneer experiments, conducted by Dr. H. E. Hammar of the U. S. Department of Agriculture, whole trees were made radioactive by feeding them irradiated phosphorus from the atomic pile at Oak Ridge.

Methods of Fertilizing Tested

The tests compared the results of conventional and unconventional ways of fertilizing pecan trees near Albany, Ga. Phosphorus, widely used in phosphate fertilizers, was chosen for the study because of the convenient 14.3-day half life of its radioactive form. This is long enough for the experiments but short enough so that the radioactivity rapidly disappears and requires no prolonged safety precautions. Dr. Hammar's preparation consisted of powdered fertilizer containing ray-emitting phosphorus 32.

Two pecan trees received 10 pounds each of this dry preparation, mixed with soil and placed around their roots. Then, using a hypodermic syringe and a liquid solution of the fertilizer, Dr. Hammar injected it through holes bored into trunks, limbs, and roots of other trees, closing the holes afterward with corks. He also tried spraying a tree's foliage.

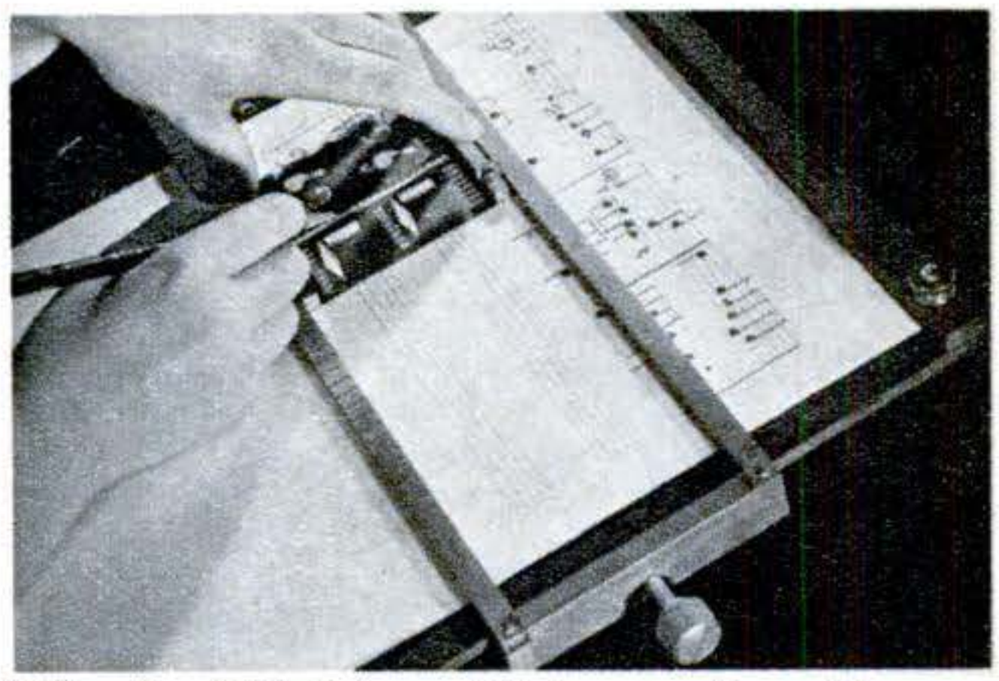
Rays Show How It Spreads

In each case the telltale rays of the fertilizer enabled him to observe its route and rate of progress to each part of the tree.

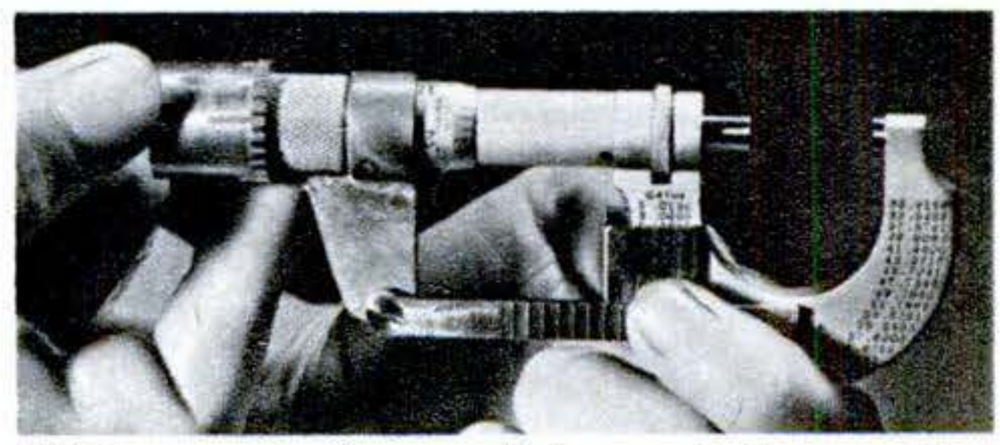
Outstanding was the advantage shown for fertilizing by injection. Only 1/40 of phosphorus placed around roots may be used, but more than a fourth of phosphorus injected directly into them is absorbed within a week and rapidly reaches every part of the tree.

This method not only would thus save fertilizer but, says Dr. Hammar: "It is logical to believe that farmers soon will be able to control the growth and health of trees to a degree heretofore undreamed of, enabling them to cause larger crops of much finer fruit and nuts." END

New Aids for The Blind



Music Writer. This pencil guide enables a sightless composer to write music at rate of a page in 12 minutes for simple tune. Symbols are positioned by using cutouts attached to guide frame. The device and those below are sponsored by the American Foundation for the Blind



Micrometer. Adapted from the standard design, this instrument works by the user's sense of feel. Larger graduations are noted with fingertips from ridges of adjacent fixed and sliding scales attached to frame. Smaller divisions are "read" from ridges on rotating thimble

Telescoping Cane. Made of chromium and brass, this walking stick collapses to 12½ in. for carrying hooked inside jacket armhole. Extended, it adjusts to 31½, 37½, or 43½ in. to suit the user's techniques of exploring his surroundings.

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Orchardist Farley fires a cloud of pollen into bee-shunned apple tree with 12-gauge shotgun. Even with bees on the job, method will increase orchard's yield up to 50 percent. Four or five shots are enough to pollinate an entire tree, and three men can cover an acre in about an hour.

Pollen-bearing blossoms are hand-picked when trees bloom in spring, usually about April 20. Only trees suitable for cross-pollination are selected, and blossoms must be plucked just as petals start to open. Time is now precious, for pollen must be extracted before bloom wilts.

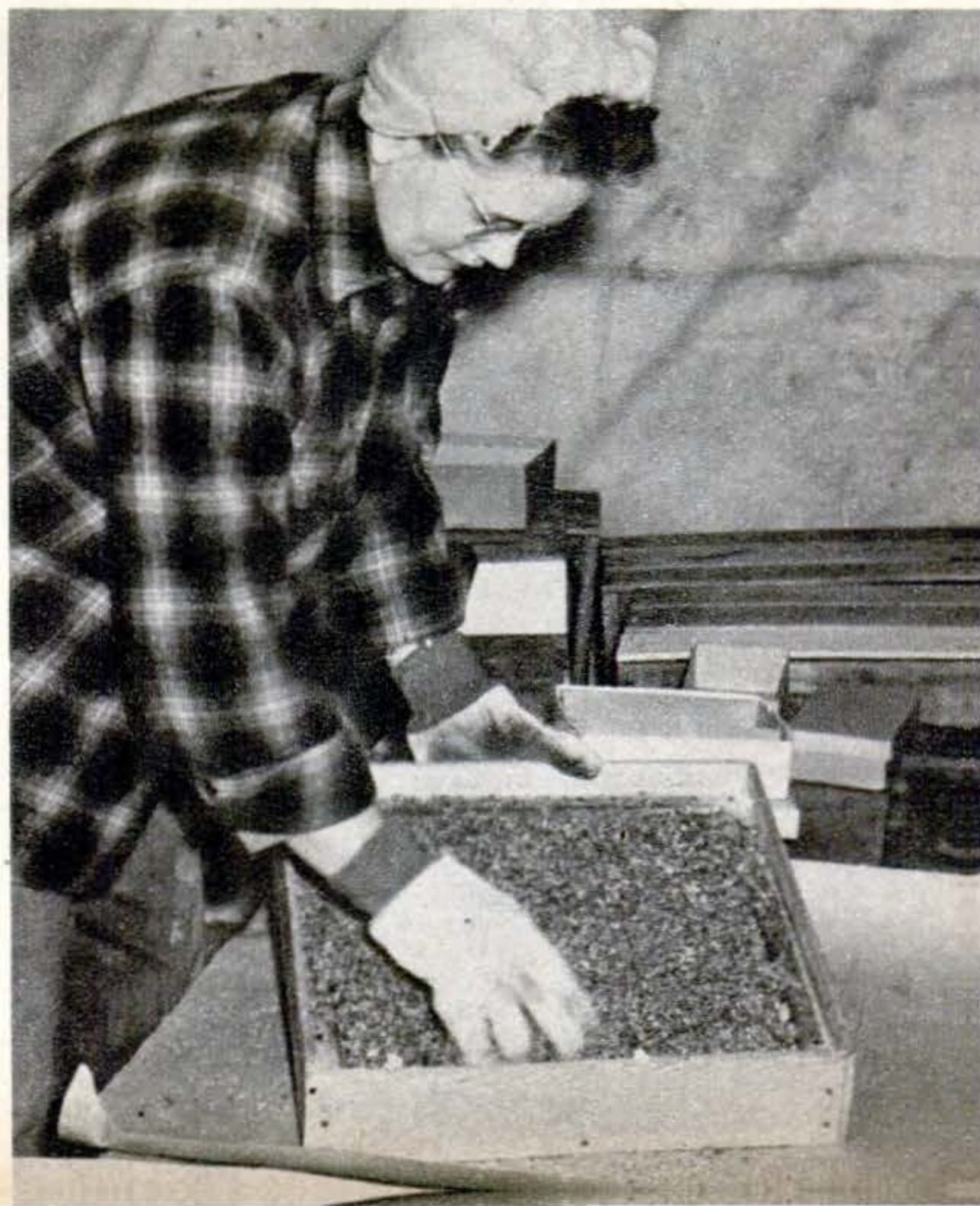
Shotgun Does Bees' Work

IF YOU'RE out in Washington's Yakima Valley this spring, you may come across L. J. Farley blasting away with a shotgun at the apple trees in his 50-acre orchard. Instead of pellets, though, his shells are filled with pollen. For this is his way of helping out nature at pollenizing time.

He started doing it back in 1943 when bad weather during the short fertilization period was making the bees, which work only when it's warm and sunny, particularly stubborn. Furthermore, pollination by hand, an emergency method requiring large crews of migratory workers, was ruled out by the wartime lack of manpower.

His new method worked so well that now Farley is busier than the bees. Come each spring, he loads up his old 12-gauge with the pollen-laden shells and goes out into the orchard to arrange another "shotgun wedding" of his apple blossoms.

Shielded by canvas windbreak, worker gives blossoms final screening to remove anthers, tiny sacs that hold the pollen. These are cured by slow drying under sun lamps at 70° F. for 48 hours in humidified room. Called bulk pollen, this contains 75 percent anthers, 25 percent pollen.



Assembly-line operation begins as freshly picked blossoms are rushed from orchard to battery of workers who rub them across coarse-mesh screens to remove their petals and expose pollen-bearing anthers. All of blossom except pollen was wasted at first. Now Farley plans to substitute discarded petals for lycopodium (moss pollen), used as carrying cloud for the apple pollen. If successful—he expects to try it out this spring—it will save time and expense of gathering moss pollen. The brief fertilization period of apple blossoms comes and goes suddenly, lasts only 48 hours.

The bulk pollen is vibrated on fine, 100-mesh screen to sift out pollen. A volume ounce—two tablespoons—yields about 130,000,000 of the tiny, football-shaped pollen grains. The pollen is then mixed, about one part to nine, with moss pollen to act as a carrier. In final step, shown below, pollen mix is tamped into standard 12-gauge shotgun shells that have part of powder removed to lighten charge. Pads between the powder and the pollen protect the pollen from the blast, and a cotton wad holds mixture in. Each shell contains about 2,600,000 grains of pure pollen.

How a Traffic Signal Works

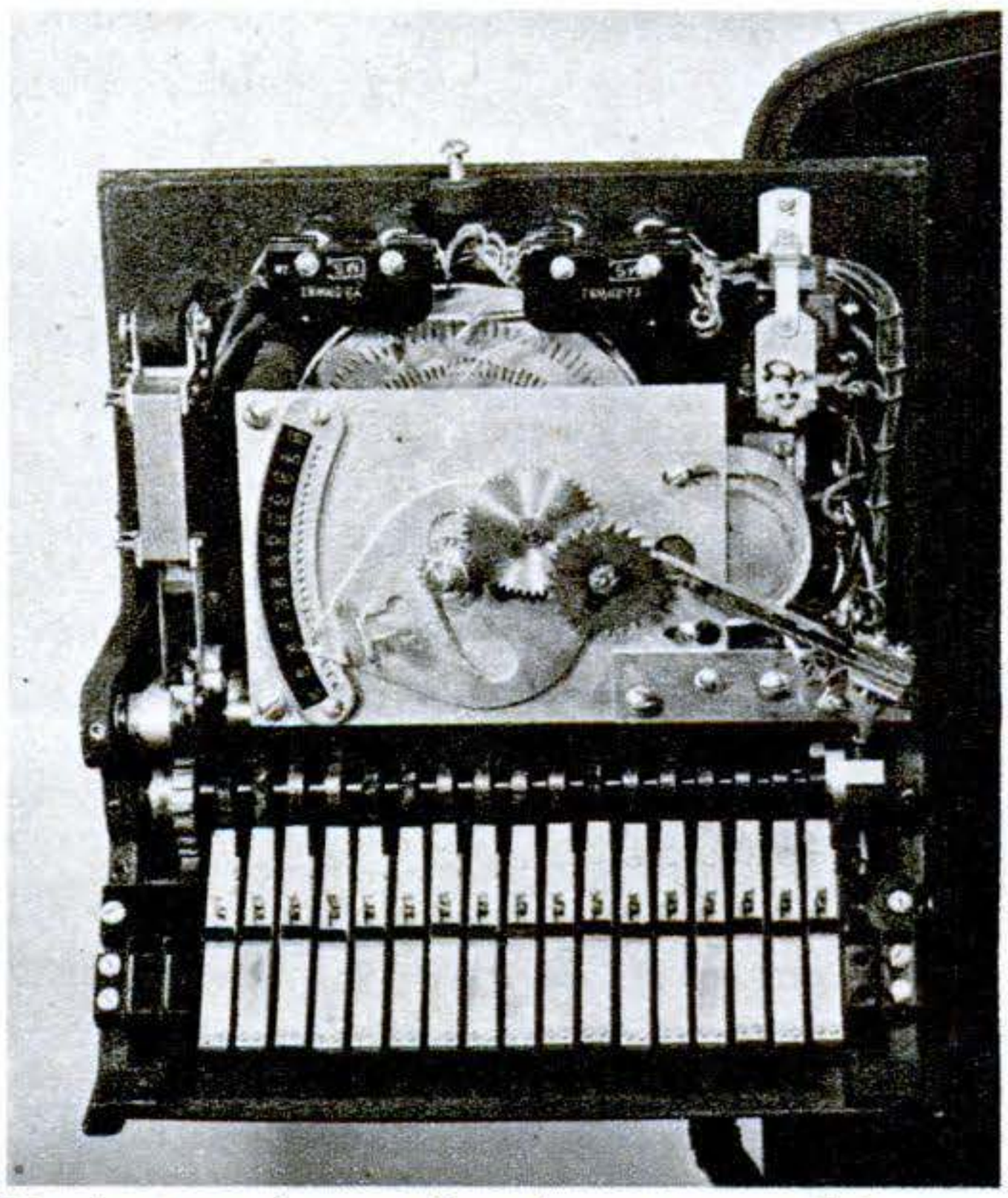
THOSE traffic signals that madden and protect you at 30,000 U. S. street and highway intersections are really alarm clocks that have been to college.

Not only do they flash the right-colored lights at the right time, and in the right sequence, but they can even correct themselves if their timing gets off schedule.

Heart of the signal is its controller, contained in a metal box usually fastened to the light pole. This complex mechanism has two main elements: a timing device, operated by a synchronous motor; and a set of switches, flicked by a series of cams controlled by the timer, to turn the lights on and off.

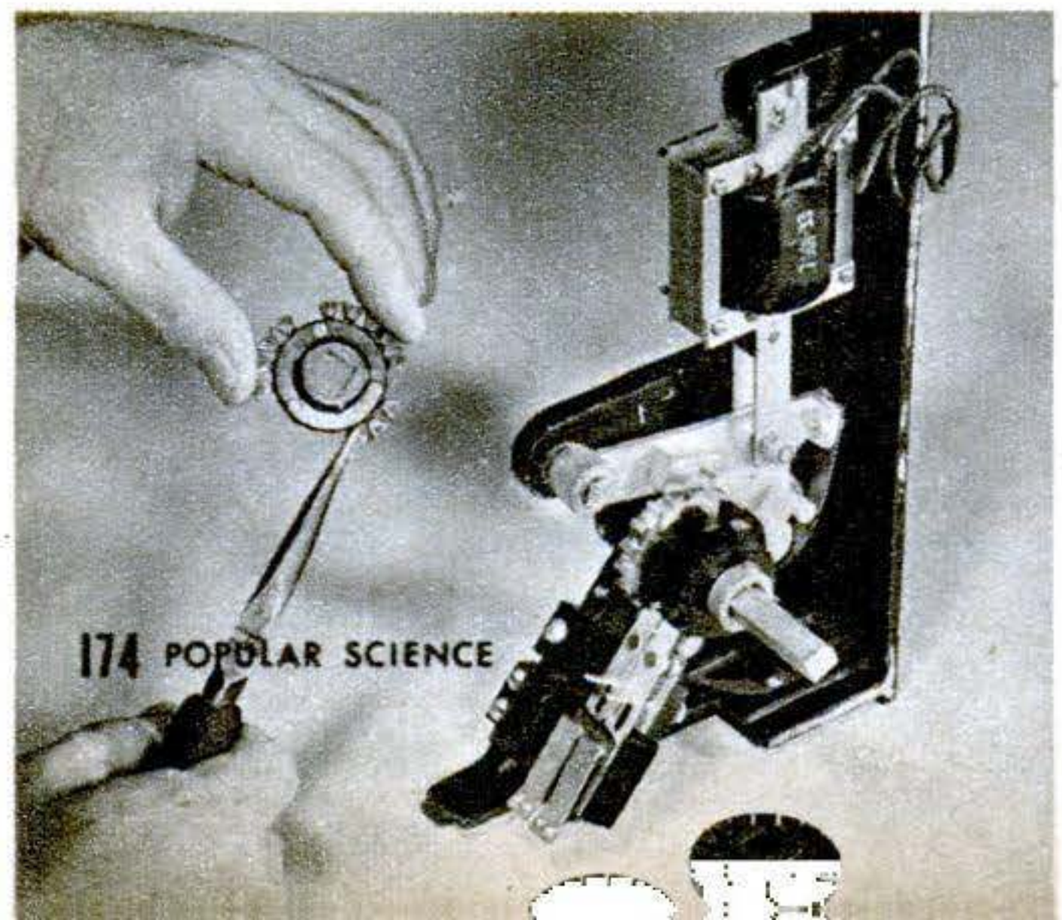
The signal shown here is made by the Marbelite Co., of New York, one of the larger manufacturers of such devices.

Time intervals for green, amber, and red lights are set by long metal keys fitted through slots on timer's outer circle. Single key on inner circle corrects signal's timing if it gets off schedule.

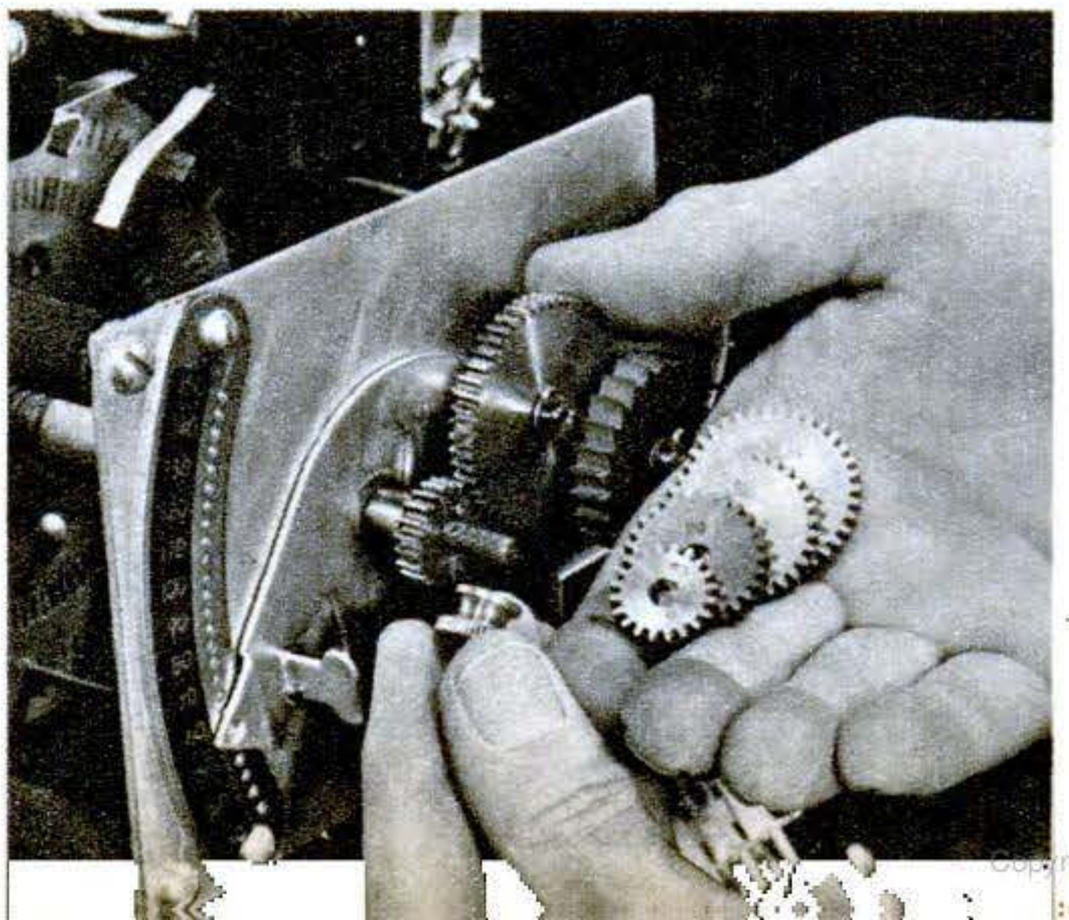


Back view of controller shows timing disk, motor, reduction gears, Microswitches®, solenoid, camshaft, light switches. The drawing on the opposite page shows how they all work together.

Closeup of solenoid and light switches (below) shows how switches' spring-steel tips finger cam contours to make and break circuits. Circuit closes where tooth on cam wheel (left) is removed.



Slip-on gears of different sizes vary length of cycle of the two lights: green-red, red-amber, red-green, amber-red, back to green-red. Gear changes shown below run from 50 to 90 seconds.



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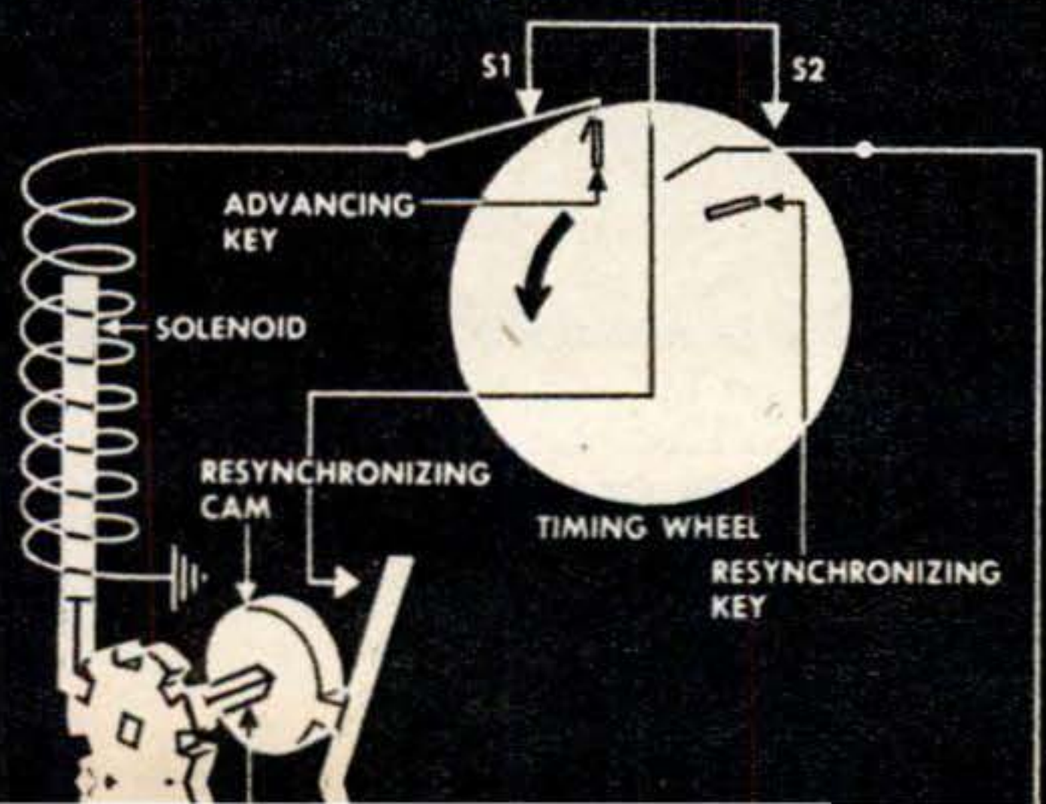
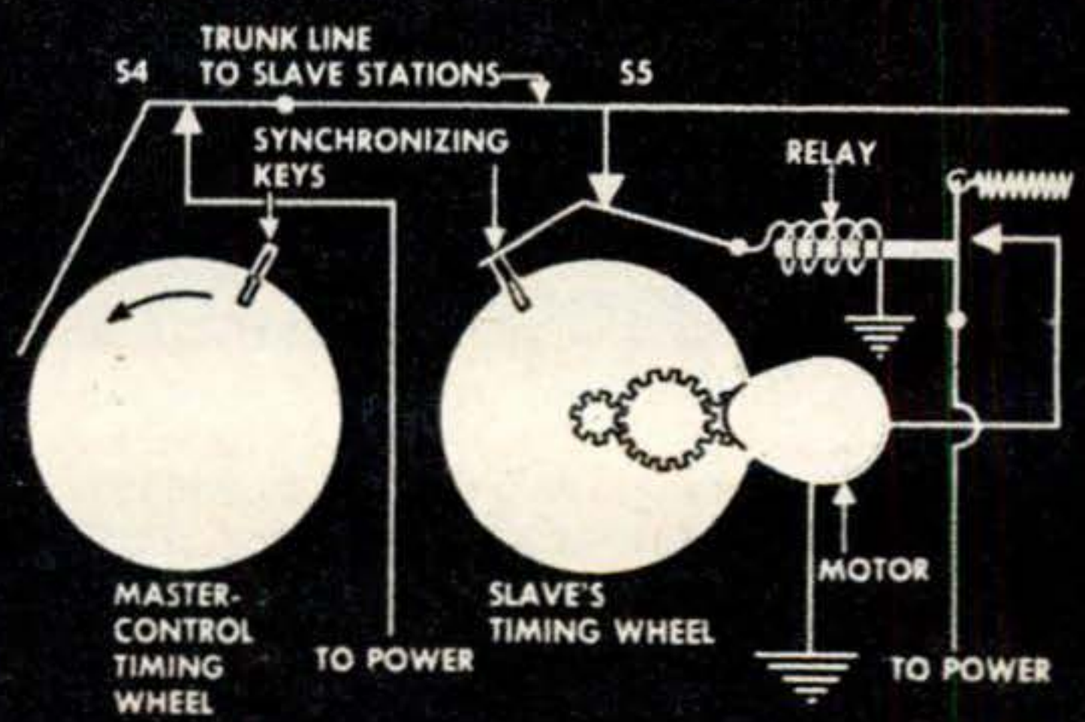
MICROSWITCHES
MOTOR
RESYNCHRONIZING KEY
ADVANCING SOLENOID
TIMING GEAR
ADVANCING KEYS
CAMS
SIGNAL CONTACTS
RATCHET
Dan Todd

Sequence of operation: Motor turns timing disk. One of keys in disk comes around and trips Microswitch on left. That sets off solenoid, which advances camshaft 1/18 revolution. As shaft turns cam wheels, one of the switch fingers encounters a bald spot on one cam wheel. This closes a circuit and turns on a light. Light stays on till switch contact is broken by tooth on cam wheel when solenoid, responding to another command from advancing key and Microswitch, gives camshaft another 1/18-revolution nudge.

How signal corrects itself: Power to solenoid (below) feeds through S-3 (Switch 3) to S-1, closed by advancing key. Once in each camshaft revolution, a cam opens S-3. If timing is correct, resynchronizing key closes S-2 at same time, completing circuit anyway. If timing is off, open circuit to solenoid halts camshaft till this key comes around. Delay puts the lights back on schedule.

How master control keeps lights on series of intersections working together: If timing wheel at slave station gets out of step with master, its synchronizing key closes S-5, contacting "hot" trunk line fed through S-4. Relay opens power switch to motor. This stops slave's timing wheel until synchronizing key on master opens S-4, allowing the switch to the slave's motor to close.





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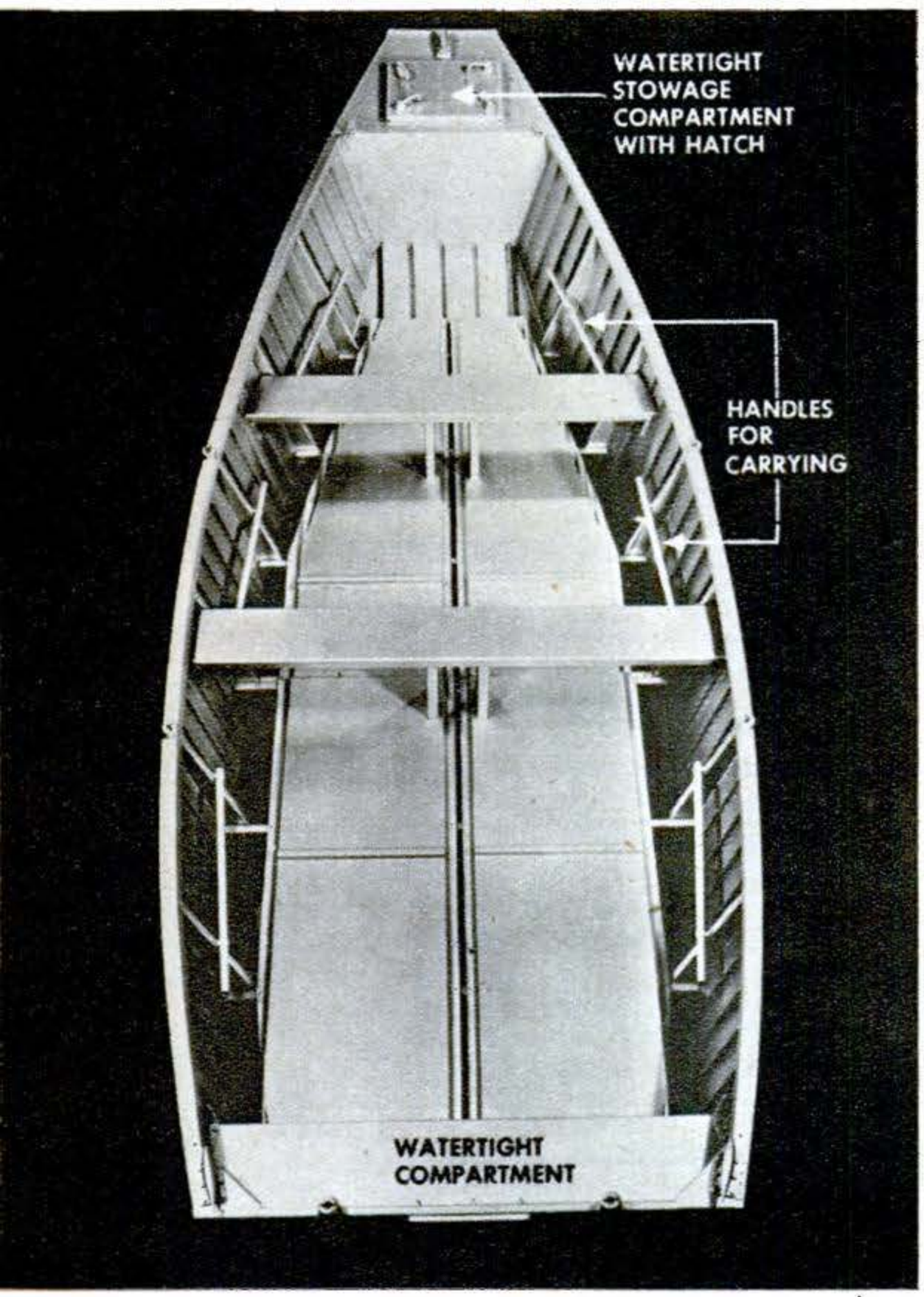
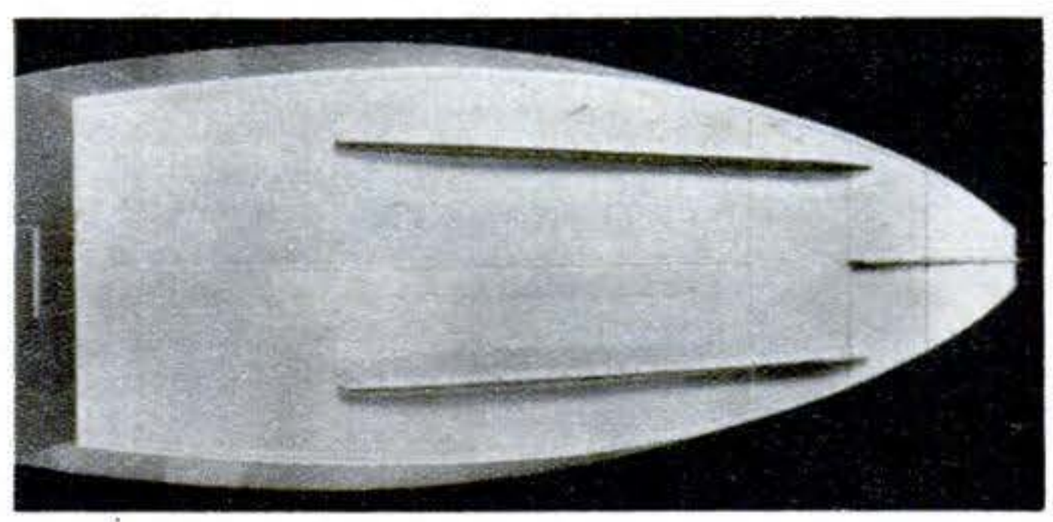
Boat's builders test it under oars and with 10-hp. outboard. Seats and floorboards lift out.



380-lb. Boat Can Double As a Sled

THIS aluminum-alloy skiff, now being tested in Arctic inland waterways, is the Army's answer to a sub-zero supply problem. Weighing only 380 lb., it can be carried by its crew of four. Afloat, it carries them plus 3,000 lb. of provisions. Runners along the bottom let it slide easily over snow and ice, while watertight sections fore and aft make the boat unsinkable. The bow compartment is accessible through a hatch for dry stowage.



Boat is 18 ft. long and has 6-ft. beam. Fully loaded, it draws 18 in. Six main transverse frames, plus reinforcing stiffeners between, provide rigidity and maximum strength with minimum weight.

Bottom is flat for easy handling and dragging over ground. Plastic runners for sliding over snow and ice are replaceable. The versatile new boat is made by the Edo Corp., of College Point, N. Y.

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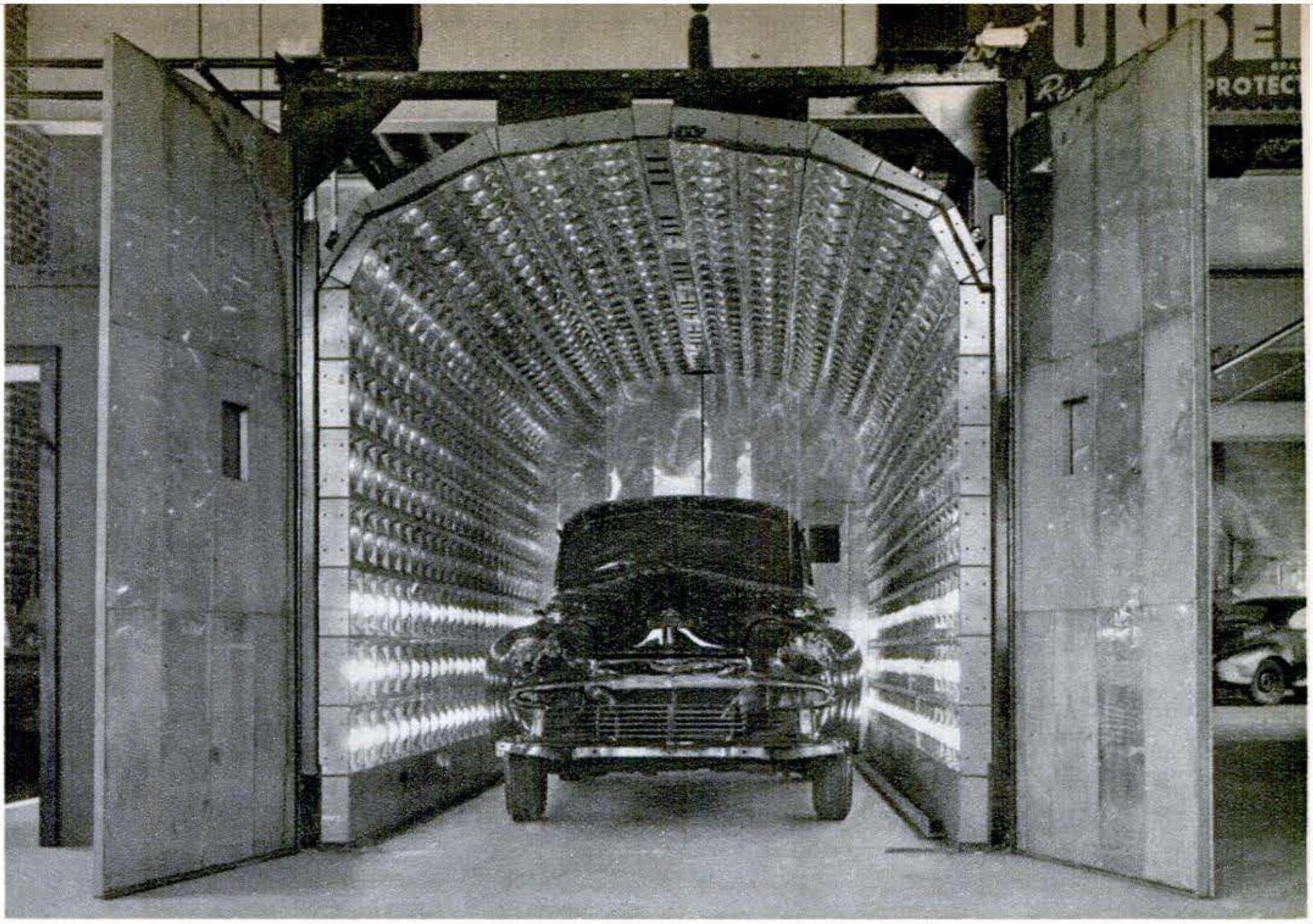


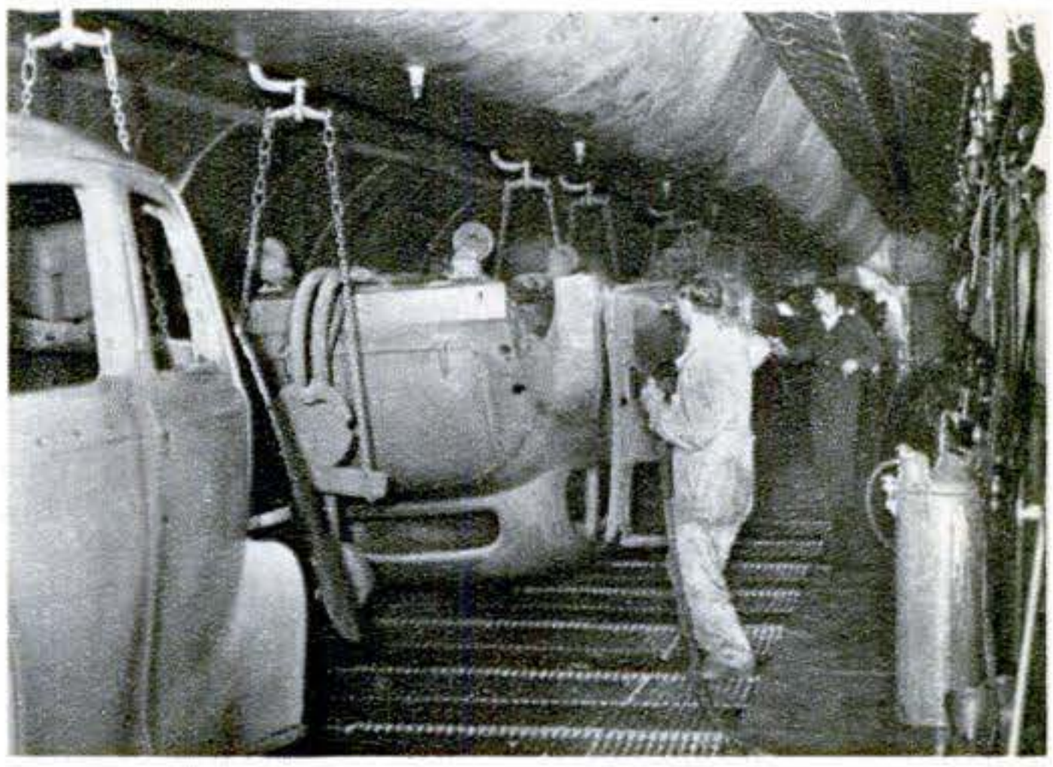
Infrared Oven Bakes New Enamel Finish on Cars

AUTO-BODY refinishing has been speeded up to a one-day job through the use of an infrared baking oven that dries an enamel coat in half an hour at a temperature of approximately 250 deg.

The ovens are being franchised to refinishers in major cities by Durabake Incorporated, Bridgeport, Conn. In addition to speed, the company claims the advantage of lowered labor cost in the processing of a car. After the body preparation it is only necessary to spray on one coat of enamel, as at the right. The car is then placed in the oven (above) for fast drying. No intermediate sanding or spraying is needed, and the usual final buffing is also eliminated.

Conveyor Speeds Car Painting in British Plant

CARRIED through this long spraying booth at the Austin Motor Company, Birmingham, England, car bodies can be painted at the rate of 1,600 a week. Rotary cradles suspended from an overhead conveyor move the bodies down the length of the plant. A counterbalancing arrangement on each cradle permits the body to be rotated by the sprayer so that he can apply the paint at the best working angle; it also allows him to reach otherwise inaccessible surfaces. Installation cost about $500,000. The plant is manned by seven sprayers.



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Gus Gets in Under the Wire

Tricky oil leaks, balky windshield wipers, and something he can't remember give Gus a hard time.

By Martin Bunn

THE morning was gray and gloomy. So was Gus Wilson's mood. He had awakened with an uneasy feeling that there was something important but unpleasant that he must attend to today. He tried to shake off the feeling but it returned with a nagging persistence.

By the time he reached the Model Garage, Gus had a first-class grouch stewing. He snapped a blunt reply to Stan Hick's cheerful greeting and he cut Greg Jones short when the grease monkey began to tell him about last night's basketball game.

Stan and Greg swapped surprised glances and shut up. They spoke to their usually good-natured boss only when it was absolutely necessary. Then they used an icy politeness that was disconcerting to Gus. Before ten o'clock, Stan and Greg had succeeded in making Gus feel like a heel.

As a result, he had worked up a good head of steam when his partner, Joe Clark, stepped out of the office a little while later. Joe was looking at a sheaf of papers he carried and didn't notice the blunt greeting Gus gave him.

"We'd better get this fixed up right now," Joe said, tapping the papers with his pen.

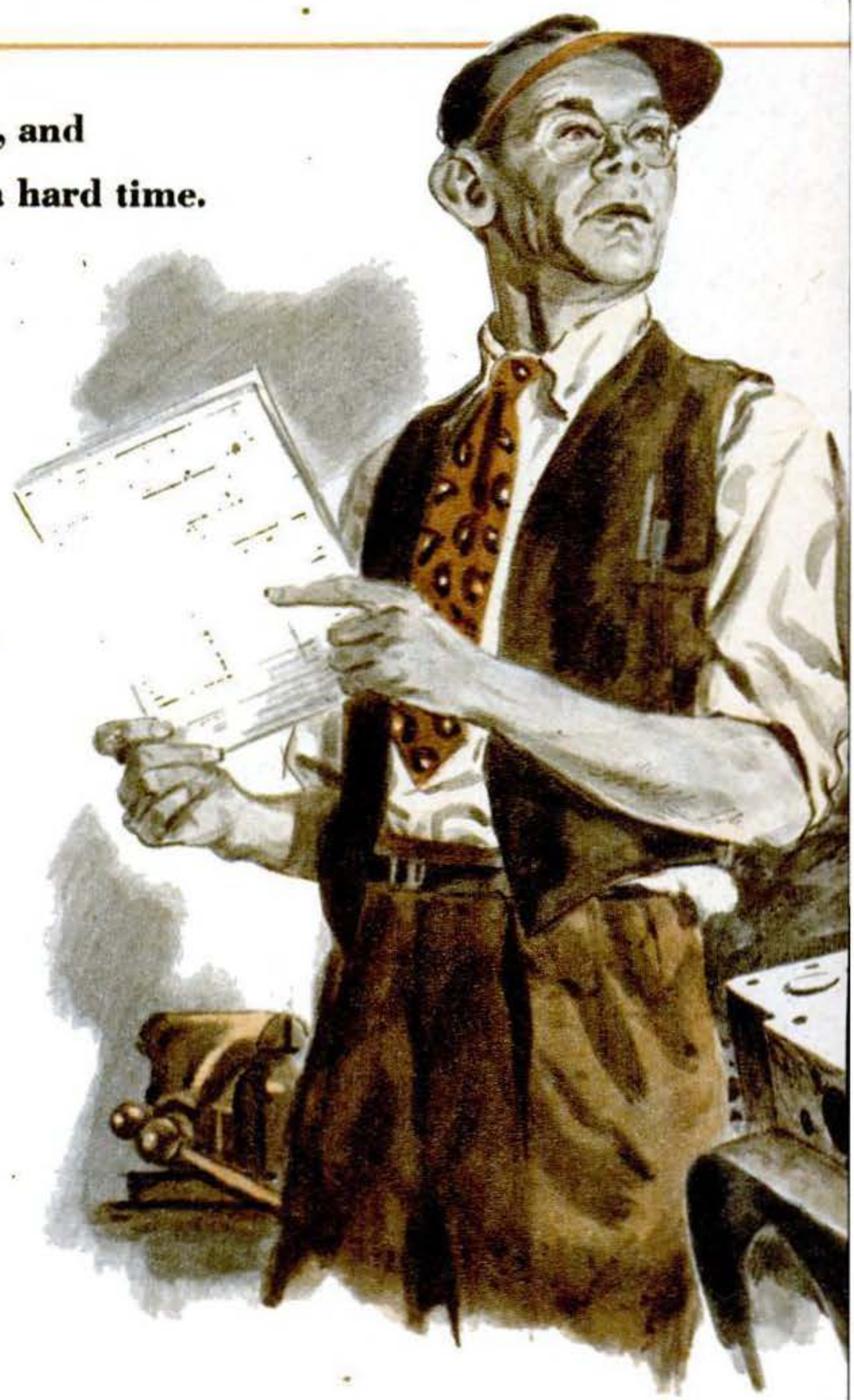
"I haven't time to fool around with a lot of your darn figures today," Gus growled. Even in his usual good humor, Gus detests paper work. "Can't you see I'm busy?" he went on. "Shop full of cars and they're all rush jobs—according to the owners."

"But . . ." Joe began.

"I don't care what it is," Gus cut in. "Whatever you've got, it'll have to wait until tomorrow—as far as I'm concerned, anyhow."

"Tomorrow'll be too late," his partner snapped, getting his hackles up.

Gus mumbled something that Joe couldn't make out and went on pulling the chain hoist.



"I don't care what it is," Gus cut in. "Whatever you've got, it'll have to wait until tomorrow."

Joe watched him for half a minute and then grinned sourly.

"All right, if that's the way you feel about it."

"That's the way I feel about it," Gus replied shortly.

Joe spun on his heel and marched back into the office, his back as stiff as a ramrod.

From that point on things got worse. The

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day dragged along slowly and gloomily. One thing after another went wrong. By lunch time, Stan and Greg were snarling at each other. Gus knew it was his fault but somehow he couldn't bring himself to make the friendly overtures he knew would break the tension. Still burrowing in the back of his mind was the consciousness of something that had to be done today, but he couldn't bring it to the surface. Every now and then he'd stop his work and try to concentrate on remembering it.

About four o'clock a horn blared outside. Greg pushed the door aside and an old sedan rolled into the shop. A fat man stepped out of it and began talking before he had both feet on the garage floor.

"After I been driving this bus for nearly ten

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years, all of a sudden she turns into an oil hog," he complained. "I put in a quart and the next thing I know it's all gone. Where or how, I don't know, but I'm fed up with always buying oil."

"I'll take a look," Gus said. There's nothing that Gus enjoys more than a trouble hunt so he perked up a bit. "Ever notice any oil under your car after it's been parked—say overnight?" he asked.

"Not a drop," the owner told him. "I lose the oil on the road but I don't know how. Had a complete motor overhaul not long ago. The garage charged me plenty but they swore the car would be as good as new. It was after that she started eating oil."

How Many Ways Can You Lose Oil?

"Stan," Gus called, "come here and give me a hand, will you?"

"What's up, boss?" Stan asked as he came from the rear of the shop.

"Got another of those tricky oil leaks to find," Gus explained as he raised the hood. "Trot around back and see if the tailpipe is oily."

"What's that got to do with it?" the fat man asked.

"The blow-by past the piston rings and valve guides can push oil out of the crankcase," Gus told him, "and it will show up as an oil film in the end of the tailpipe."

"No oil back there," Stan reported.

"Well," Gus sighed, "we've got to do some careful looking."

Evidence suggested that the main-bearing seals were tight. So were the cap screws holding the oil pan. All visible gaskets seemed okay. Gus turned to the clutch housing.

"How could that have anything to do with it?" Stan asked. He'd almost forgotten the earlier unpleasantness.

"If the breather holes in the clutch housing are clogged with mud or grease," Gus answered, "that might cause the clutch assembly to suck oil. But this is okay."

"I didn't know there were so many ways of losing oil," the fat man said.

"There are dozens of ways," Gus said, "and some of them are very tough to find."

"How about that one we had last week?" Stan put in. "The breather pipe."

"Yeah," Gus said, "that was a real tough one. We had to work the paper dodge on it."

"What's this business about the breather pipe and the paper dodge?" the man wanted to know.

"Well," Gus began, "that car had been losing oil, too. I tried every test I knew to find the leak in the shop, but no soap. So we tied a big sheet of heavy wrapping paper under the engine and took the car on a road test. When you come back from a test like that and find oil spots on the paper, you usually can tell where the leak is."

"Yeah?" said the fat man.

"Sure," said Gus. "Just untie the paper and hold it over the engine in the same relative position. Then notice where the spots are and check the engine parts under them."

"It sure found that one," Stan said.

"What was the trouble?" the new customer asked.

"The engine's rear breather pipe," Gus replied. "You never could have found it by checking in the shop. Had to take the car out and run it. When the car was moving, the wind stream across the outlet of the rear breather pipe built up a vacuum in the pipe that caused the oil leakage. A few small holes drilled in the pipe stopped the vacuum from forming and ended the leak. It's a simple cure but a tough leak to locate."

"Maybe that's where my leak is," the owner said.

"Nope," said Gus. "There isn't any oil on the pipe. There would be if you were losing it there. I checked."

"Then let's get started with the paper test," he urged.

"Not so fast," said Gus. "I want to check the oil lines first. Start the engine, Stan." Gus bent over the engine again and began checking the oil lines and fittings. After a few minutes he straightened up.

"Find it?" the owner asked.

"Yep," Gus answered, "here's your oil thief." He pointed to the nut securing the input line to the oil filter. "I found a thin film of oil on this line and it led to the nut. When your engine was reassembled after that overhaul, the nut wasn't tightened enough. That caused a leak when the pressure was high and the oil was warm—say at fairly high-speed road driving. At low speeds or when the oil was cold, the fitting didn't leak. A little tightening will fix it up all right."

Rain Brings More Trouble

"So that's what's been wasting my oil," the fat man groaned. Then as Gus turned from tightening the nut, the man said: "This has been one tough day, hasn't it?"

Gus looked at the fat man closely and then,

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without knowing why, he agreed with him.

"Well, I've got it done, anyhow," the man added as he climbed into his car.

"What—the day?" Gus asked.

"Are you kidding?" the man grinned, putting his car into gear.

As the shop door closed behind the old sedan, even the weather took a turn for the worse. The gray murk thickened into an icy rain driven by a howling March wind. Sheets of water lashed down on the highway and rattled against the shop windows.

Before long there was another horn squawking outside the shop door. Stan opened the door to let in a water-streaming coupe with its headlights burning. Joe Williams, the City Alarm's local reporter, jumped out. Gus noticed that Williams, too, looked like he'd had a rough day. What's the matter with everybody, Gus wondered.

"Never thought I'd make it here," Williams said. "What a rain!"

"What happened?" Gus asked.

"Couple of miles up the highway my windshield wipers almost stopped working. I couldn't see where I was going." The reporter glanced at the shop clock and let out a yelp. "For the love of Mike, fix those wipers quick, Gus. I've got to get to the post office to catch the 5:30 mail. It's the last one out."

"I'll do my best," Gus said, "but I never make promises about slow wipers until I find what makes 'em slow. Sometimes you can fix 'em quick, sometimes not."

"This just can't take a long time," the reporter groaned.

Gus Wakes at the Count

While Williams hopped around nervously, Gus checked the wiper hose for air leaks, but found none. He disconnected the wiper motor, examined it, and replaced it. Nothing seemed to be wrong with the motor, but when he switched on the wiper, the blades still swept slowly across the windshield.

"How about it?" Williams asked.

"It might be," Gus said, "that the manifold vacuum is low. Finding out why and fixing it might take a long time."

"I tell you," Williams almost screamed, "that I'll be sunk if I don't catch that 5:30 mail. There must be something you can do. Come on—pull a miracle out of your hat. You've done it before."

While the reporter raved, Gus disconnected the hose. He held it up to the light, looked through it, and laughed. The hose showed no outside bulge but the inch nearest the intake manifold was so swollen inside that the aperture was almost closed. Gus handed the hose to Williams and told him to take a look.

"The heat and manifold fumes broke down the rubber," Gus said. He cut off the swollen section and replaced the hose. The wipers swept back and forth vigorously.

"Open that door!" Williams yelled, jumping into his car. "I'll pay you on my way back. No time now. I've got to catch that mail. If your return isn't postmarked the fifteenth, it means a fine."

Gus watched the coupe shoot out of the shop.

"Return . . . fine . . . what's the matter with that guy?" he muttered. Then it dawned on him. "Holy cow!" he yelled. "Joe! Joe Clark!"

"What's biting you now?" his partner asked from the office door.

"I've forgotten to make out my income tax and it's got to go in today. You'll have to help me. I always get it all balled up. I've known all day there was something that I had to do, but I couldn't . . ."

"All you've got to do is sign your name," Joe laughed. "Don't you remember you gave me the dope right after the first of the year? It's made out and I tried to get you to sign it this morning, but you were so crusty that . . ."

"Never mind that now," Gus snapped. "Gimme the blank and a pen. I've got to get that 5:30 mail. You don't want to see me pay a fine, do you?" END

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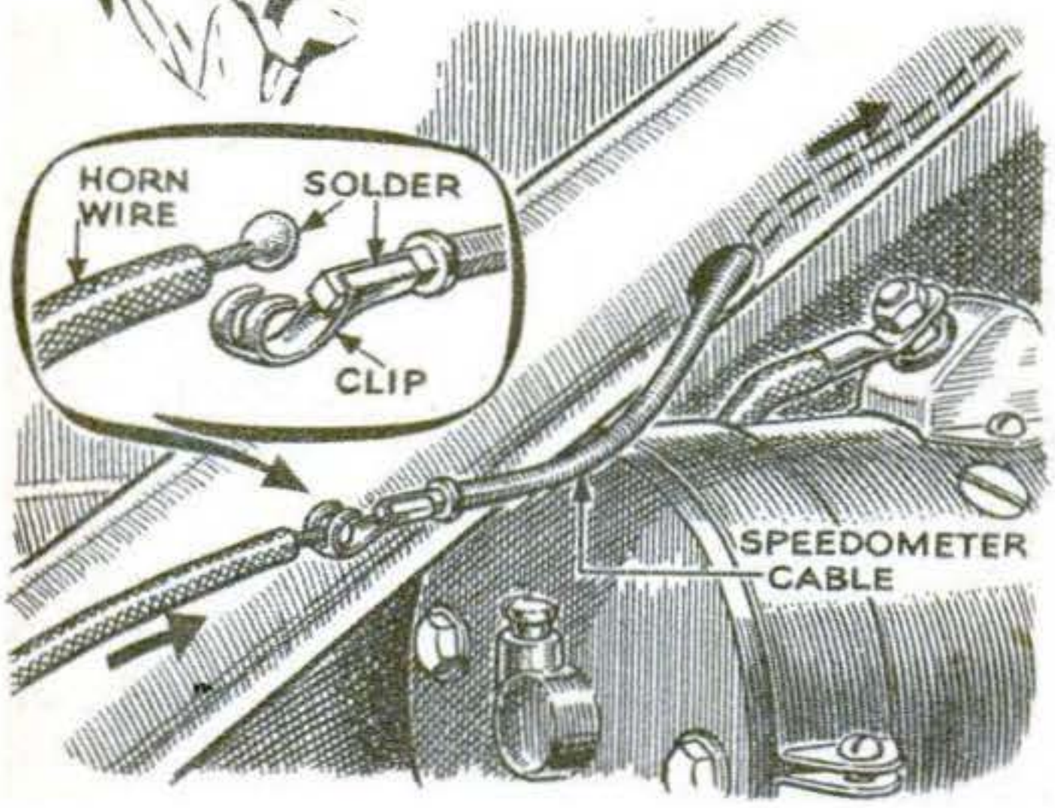
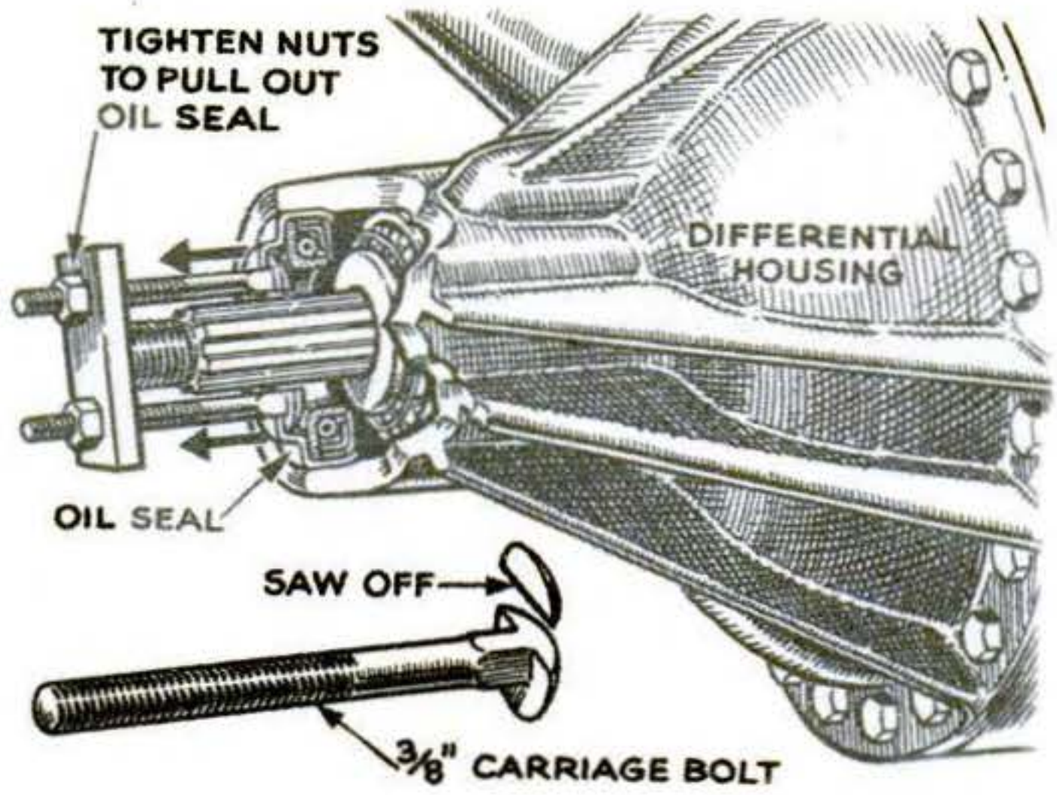
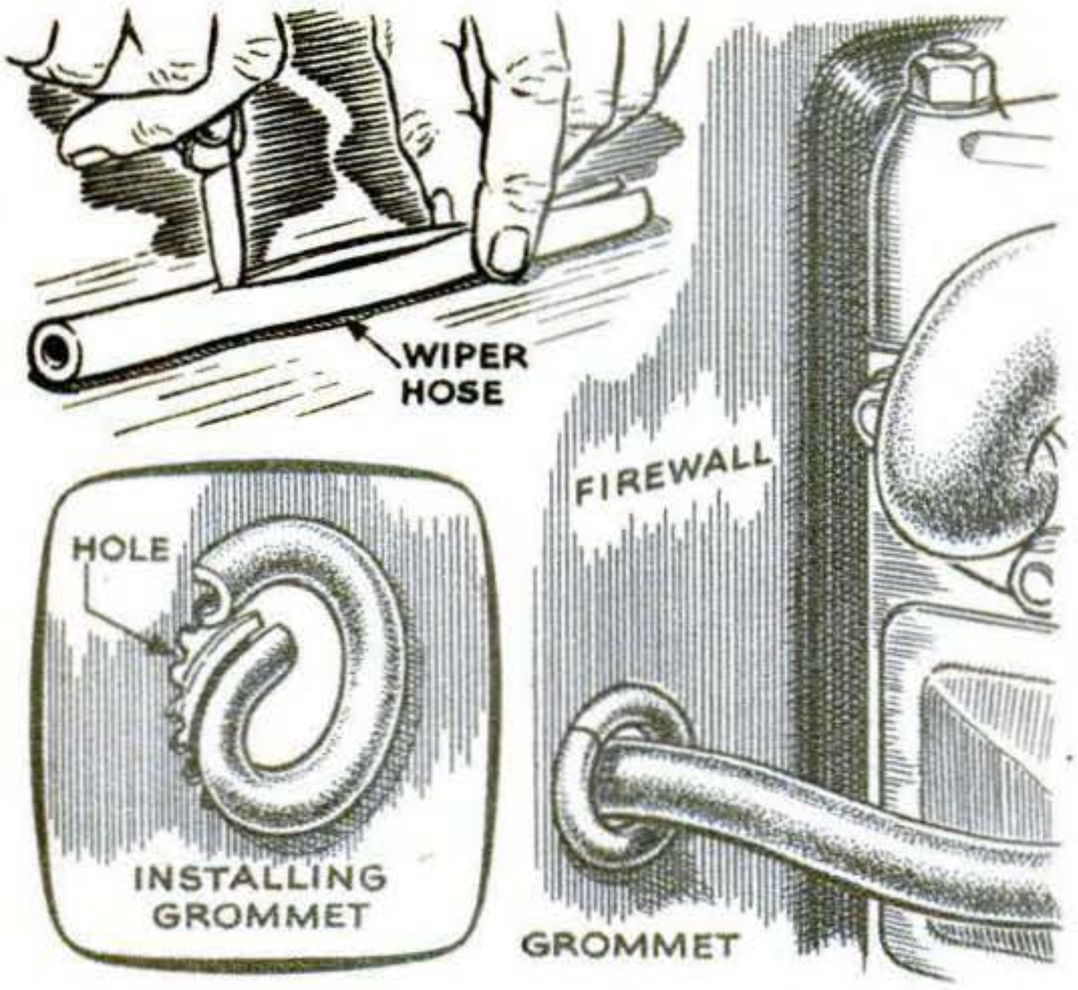
Hints from the Model Garage



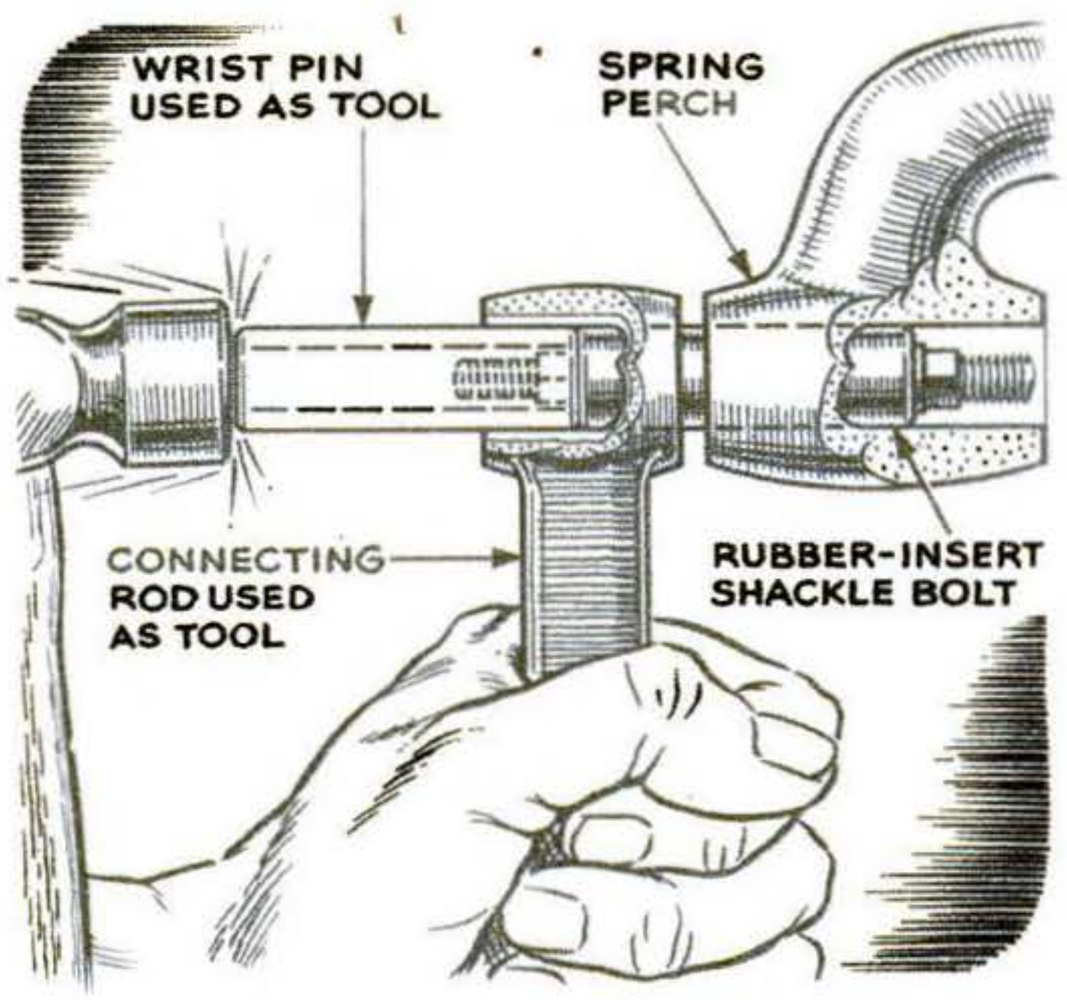
Speedometer Cable Fixes Horn. A good way to replace defective horn wiring is reported by Lester L. Haberman, of Hartford, Conn. Instead of fishing wire through the steering column, he uses a broken piece of speedometer cable as a leader. A bent clip soldered to the end, small enough to pass through the hole in the column, hooks the horn wire to pull it through. A blob of solder on the tip will engage it securely.



Bolts Pull Oil Retainer. The oil seal on the differential housing of one Plymouth seemed to be in for good, but Stanley T. Lusas, Woodbury, Conn., found a way out. Sawing a flat on two 3/8" carriage bolts, he was able to slip the altered boltheads into the groove from which the felt ring was removed. By alternately tightening nuts against a simple bar yoke, he drew out the seal. Different bolts may be needed on other cars.



Grommet Guards Heater Hose. In making a hole in the firewall for heater hose you may have to drill a circle of holes and chisel out between them. Protect the heater hose from the jagged edges by slitting a piece of windshield-wiper hose and cementing it around the rough inside edge.



Wrist Pin Drives Shackle. When installing rubber-insert shackle bolts, George Pedley, of N. Grosvenordale, Conn., uses two other parts as tools. A wrist pin, annealed by heating, is employed for driving the bolt, and a connecting rod is used as a guide to keep the rubber from expanding.

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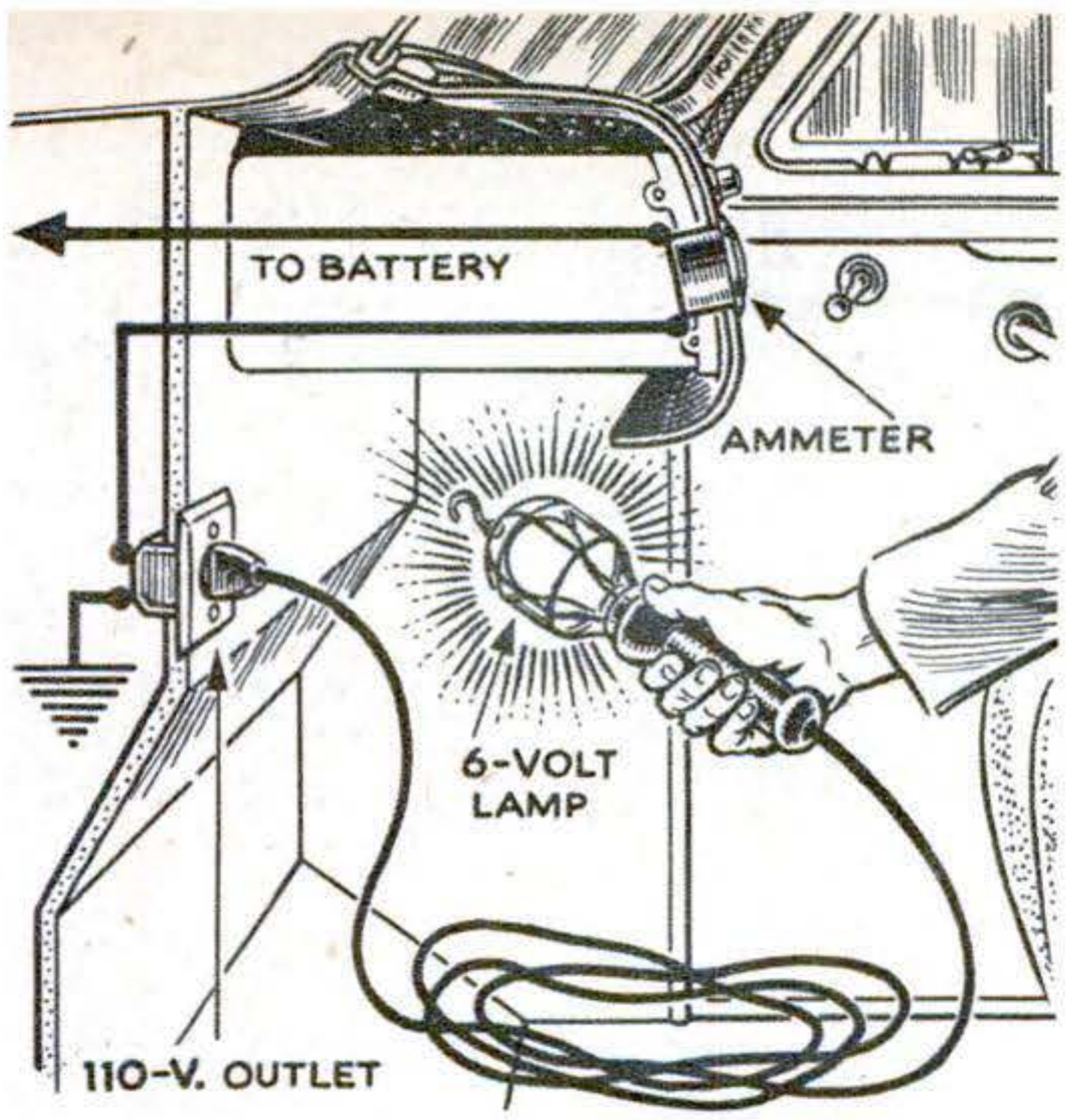
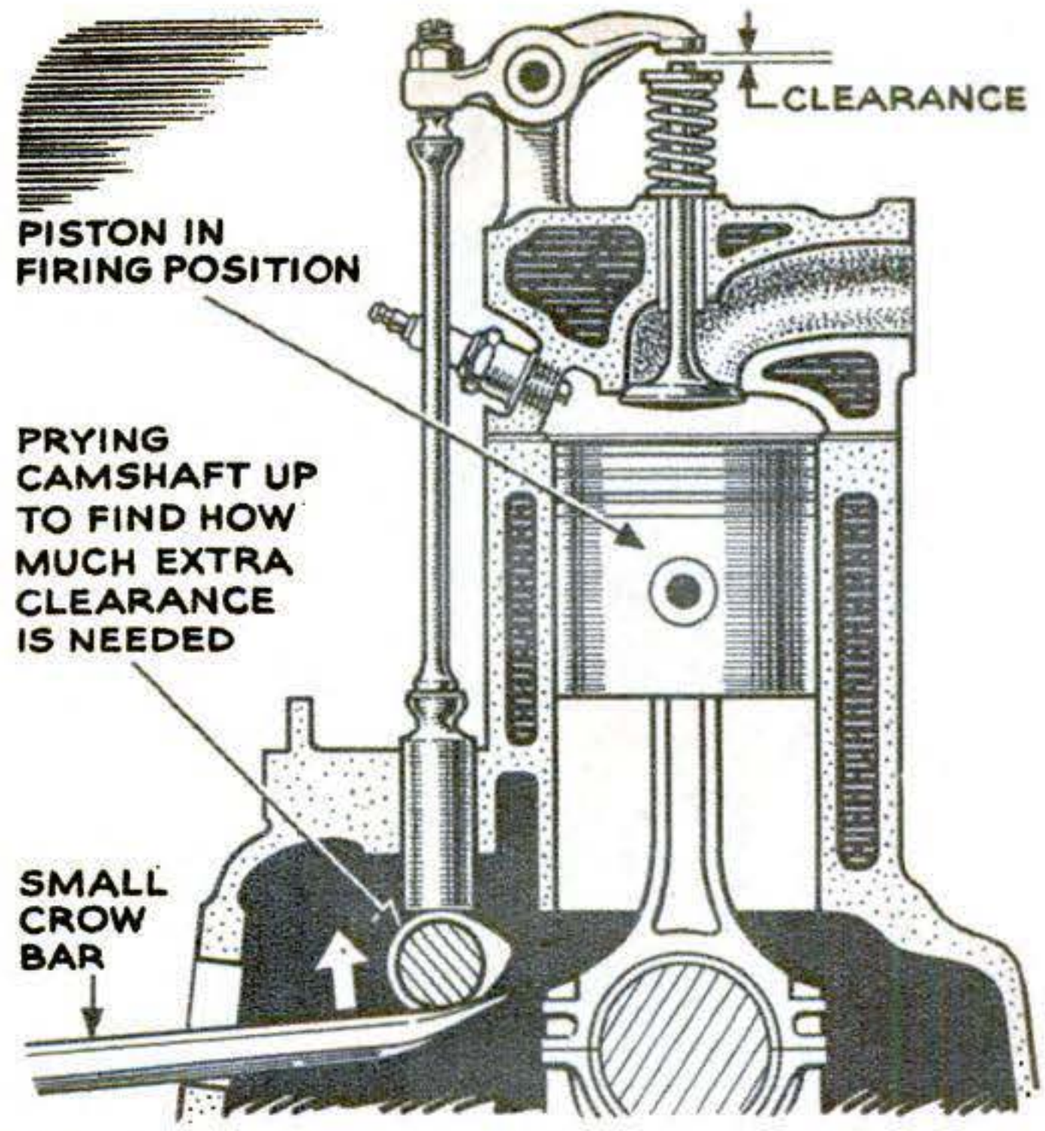
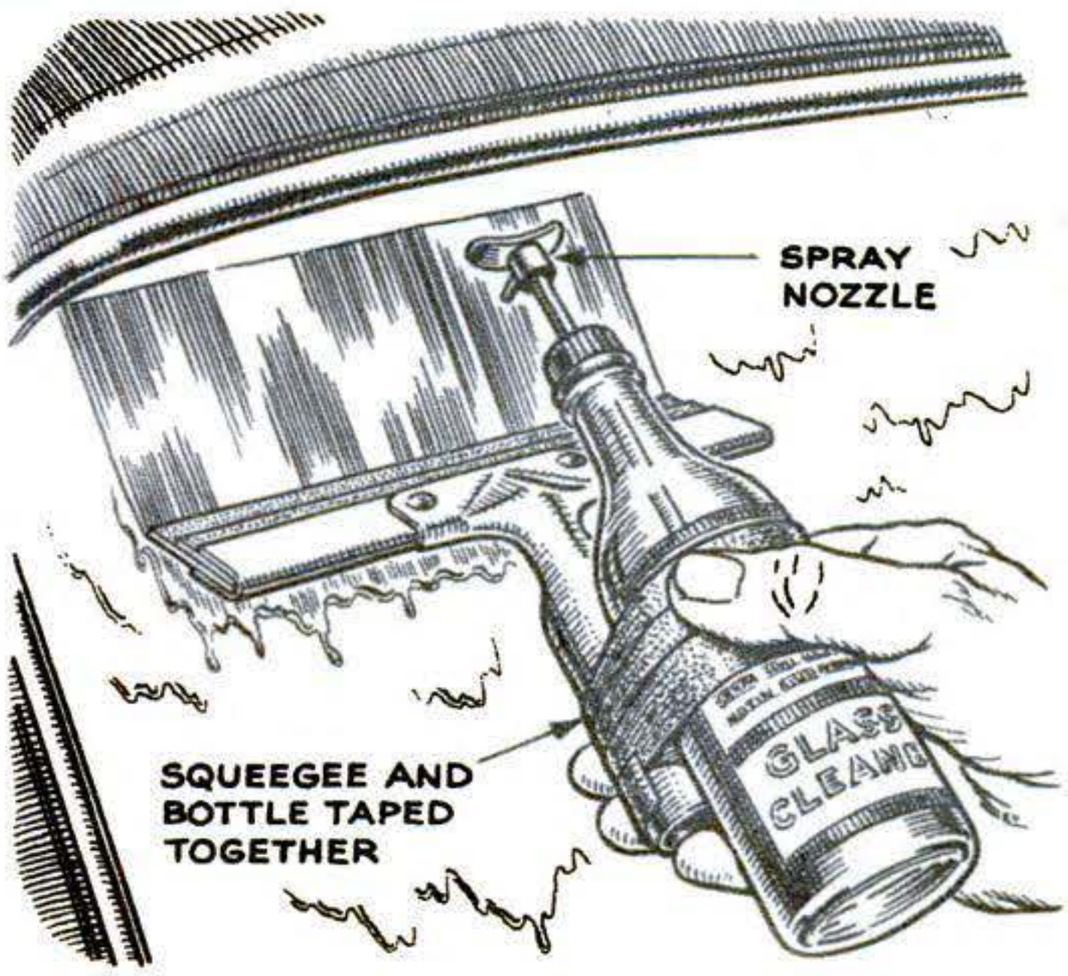


Trouble Light Doubles in Car. One extension cord kept in the car is always available for use as a trouble light with the accessories added by W. M. Dierks, of Chicago. He installed a standard 110-volt outlet in the car, wiring it from the ammeter to ground. At the other end is a 6-volt bulb with a standard screw base. For use on house current it is only necessary to replace the bulb with a 110-volt one.



Wear Alters Clearance. Worn camshaft bushings may cause burned valves by reducing the apparent tappet clearance. Caral Lee, of Weld, Me., suggests this test for Chevrolets: Set the No. 1 tappet, remove the fuel pump, pry up the camshaft, and recheck the clearance. Since the camshaft tends to ride at the top of its bushings during rotation, the measured difference should be added to the normal clearance.



Unit Windshield Cleaner. Tape a rubber squeegee to a bottle of glass-cleaning fluid fitted with a spray nozzle, writes Sally Mills, of Syracuse, N. Y. When the windshield needs cleaning you only have to dig out the one unit to spray the fluid and wipe it off immediately.

Stool Built of Brake Drums. One mechanic made his job easier by welding two discarded brake drums together. Four casters on the bottom and a sheepskin buffing pad on top make it a serviceable rolling stool. It's particularly good for jobs for which you'd ordinarily have to kneel.

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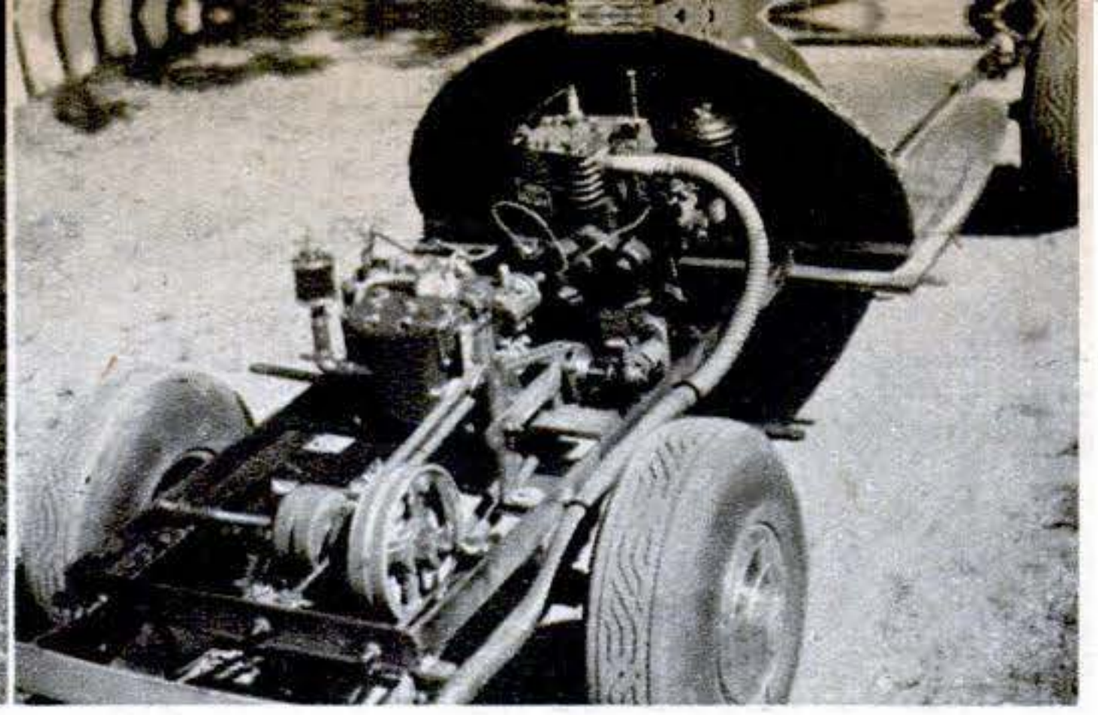
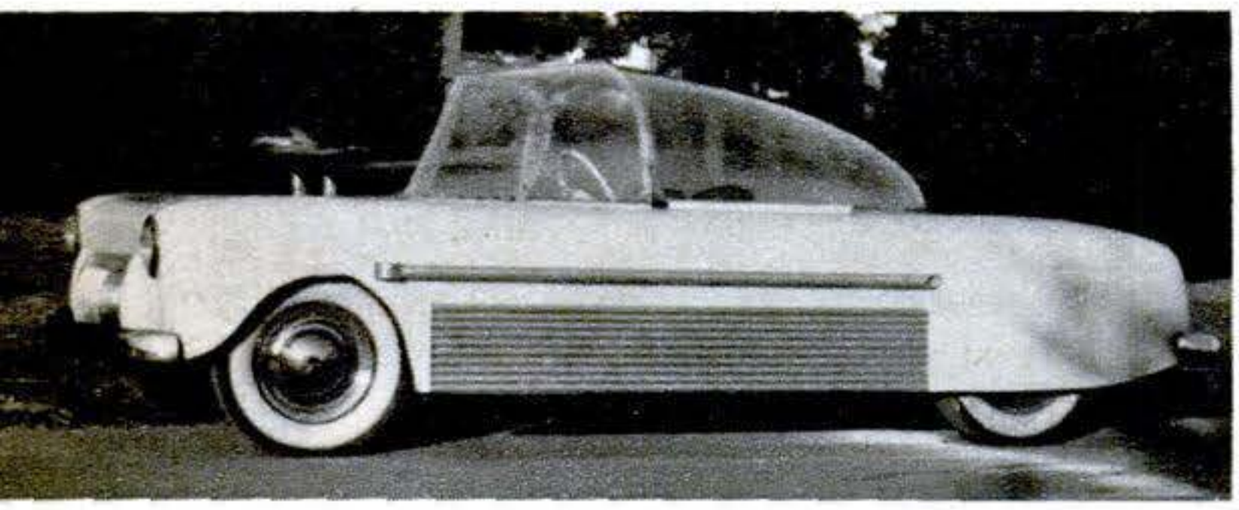


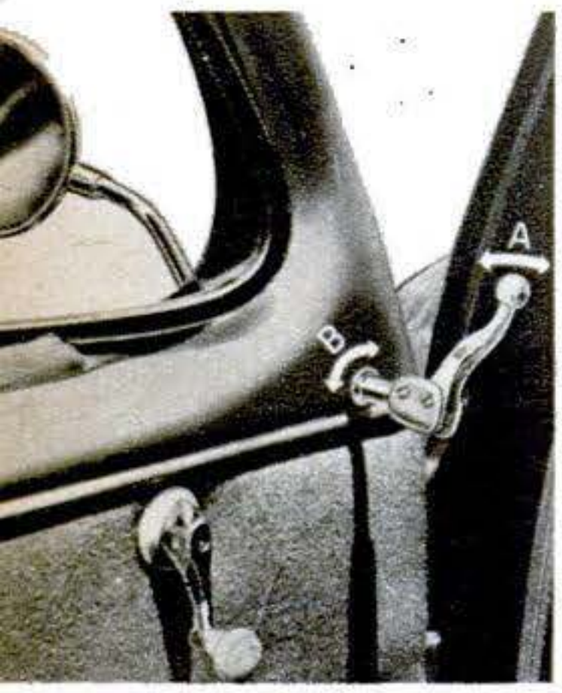
Surplus Parts Made into Streamlined Midget Car

THE State of Michigan collects $4 a year license fee from Dale and Dick Kitchen, above, which should be sufficient proof that the speed wagon they are riding in is no toy. Built for them by their father, Jae D. Kitchen, of Caro, this car can do about 12 m.p.h. A 1½-hp. gasoline engine supplies the power; it is joined by a flexible coupling to a hydraulic transmission of the type used for turret control on bombers. The transmission operates in either direction, and automatically returns to neutral. In this position it has a locking action that serves the car for brakes. An airplane gas tank was split in two to make the streamlined body. A grille is welded in front. The uncovered rear view at the right above shows the motor and transmission and the double V belts that go from the transmission to a jack shaft and then to the axle shaft. The left rear wheel is the powered one. Approximate cost for all parts, including the motor, was $350.



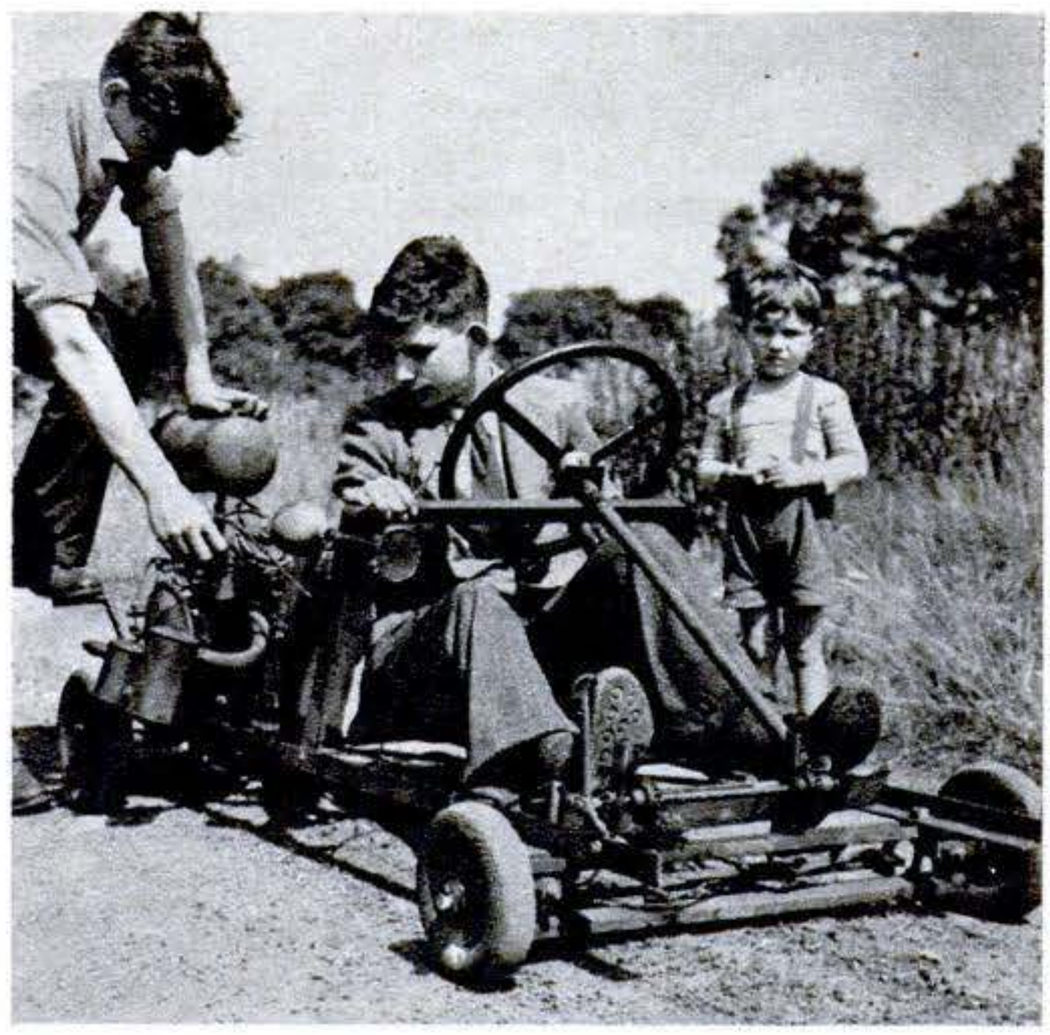
Plastic Dome Tops Hybrid Auto

A MIXED assortment of old automobile and aircraft components went into this home-made car built by Ray Sears and his son Vernon, of Tulsa, Okla. It took them about six months of spare-time work to complete this answer to the new-car shortage. Auto parts ranging from Ford to Cadillac are represented. A Ford V-8 engine with dual carburetion and other modifications was used. The builders estimate 100 m.p.h. top speed.



Side Mirror Has Fingertip Control

INSIDE adjustment for outside mirrors is provided by Saf-T-View® side mirrors, made by Trout & Lewis, Glendale, Calif. The lever plane marked A is for horizontal movement; B is for vertical. Together they eliminate most blind spots.



Car Built Entirely of Scrap

AIDED by two youthful friends, 16-year-old Brian Lloyd-Jacob, of Banstead, Surrey, England, built this odd-looking but useful vehicle entirely from cast-off parts. Cash outlay totaled only 12s. 6d. (about $2.50). Economical in operation as well as construction, the car gives about 65 miles a gallon and has a road speed comparable with that of much larger cars. Parts from scrap heaps and junk yards make up the bulk of the materials. Peter Billing and Geoffrey Fletcher helped in rounding up and assembling the components. Photo shows Brian working the kick starter. Geoffrey is at the wheel.

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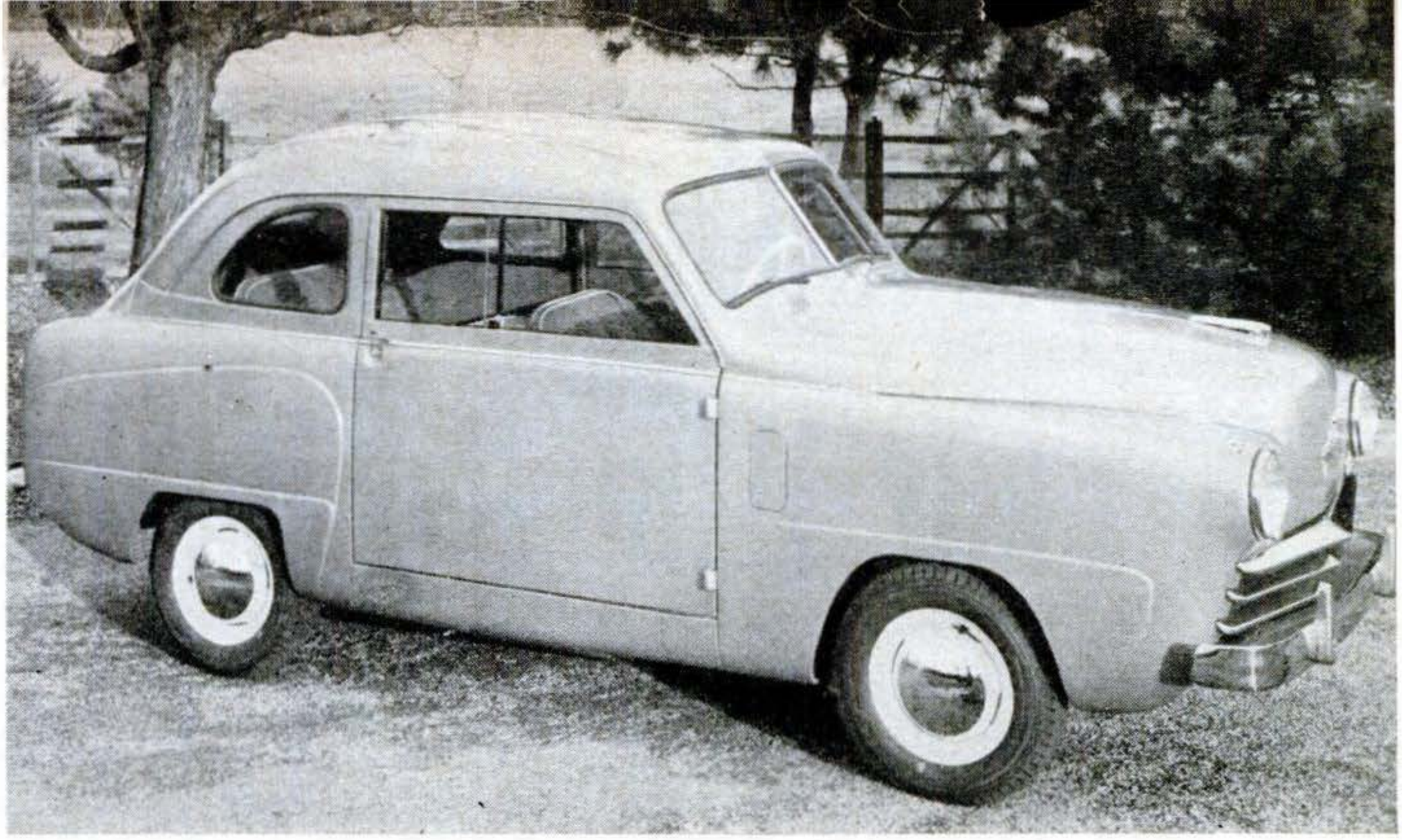


Extension of fender lines and fender-housing of headlights give sedan graceful appearance.

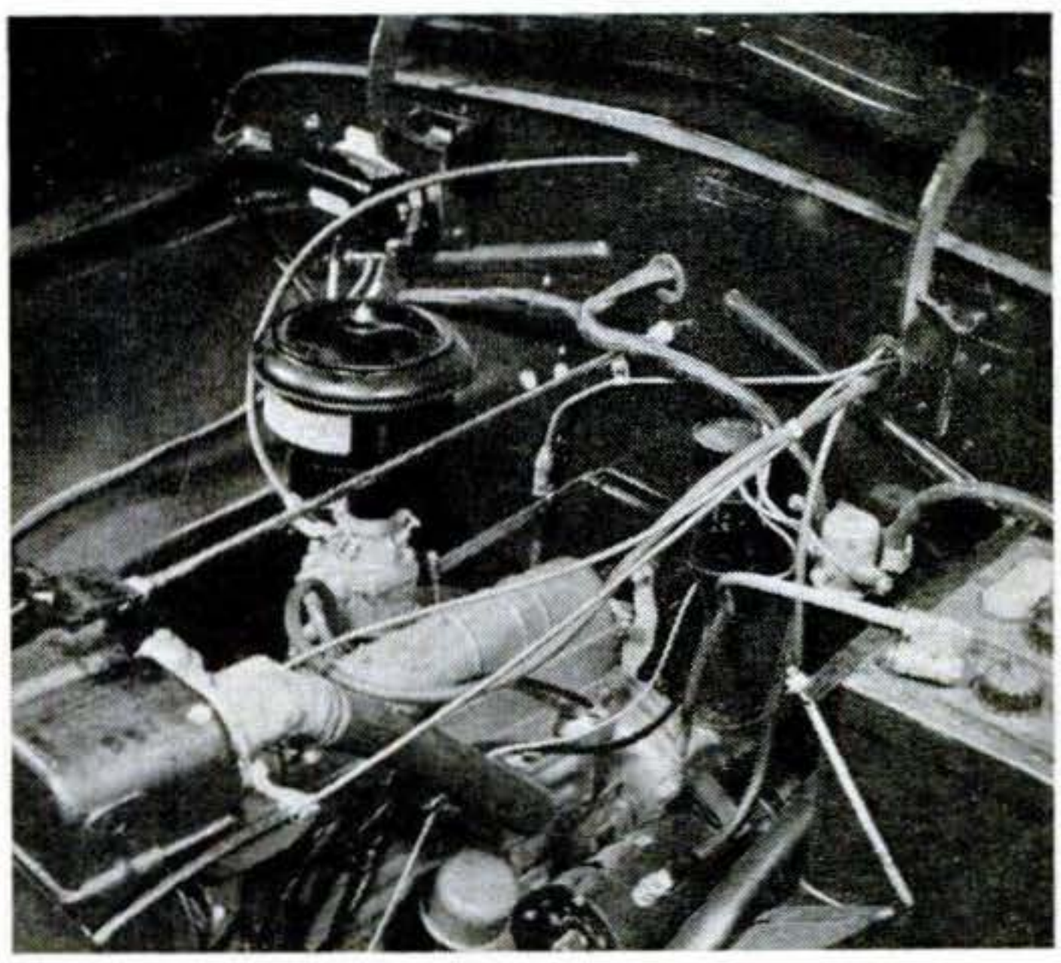
Little Crosley Looks Bigger

AMERICA'S smallest car has taken some hints from its big brothers. The Crosley, recently restyled to look larger, now also has such big-car features as sealed-reflector headlights, blinker directional signals, and two windshield wipers instead of one.

Nor is this all. Compression of the four-cylinder, valve-in-head 26.5-hp. engine has been raised to 7.8-to-1. Company engineers say this adds about 5 miles per gallon to the gasoline range. With 7.5-to-1 compression, this was 35 to 50 miles per gallon.

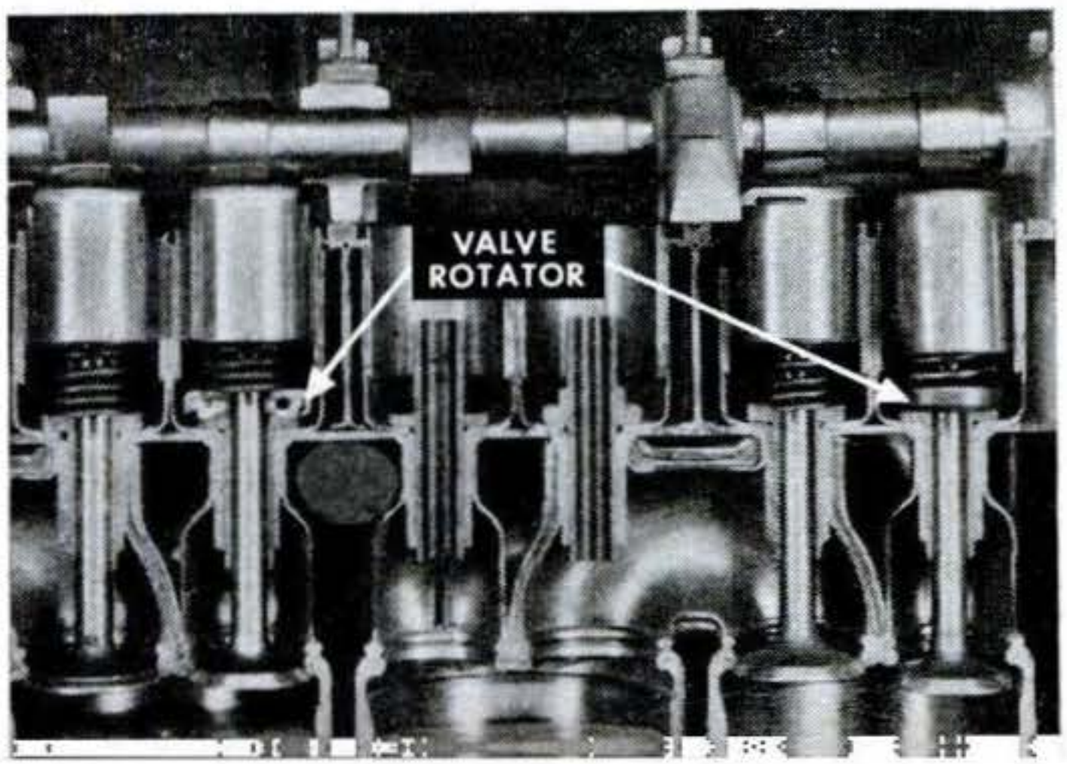
Rotators have been added to the exhaust valves. These cause the valves to turn a fraction of an inch each time they open, allowing bits of carbon and other combustion products to pass into the manifold. This reduces wear and pitting of the valve.

Four-ring pistons with the top ring chromium plated reduce oil consumption.

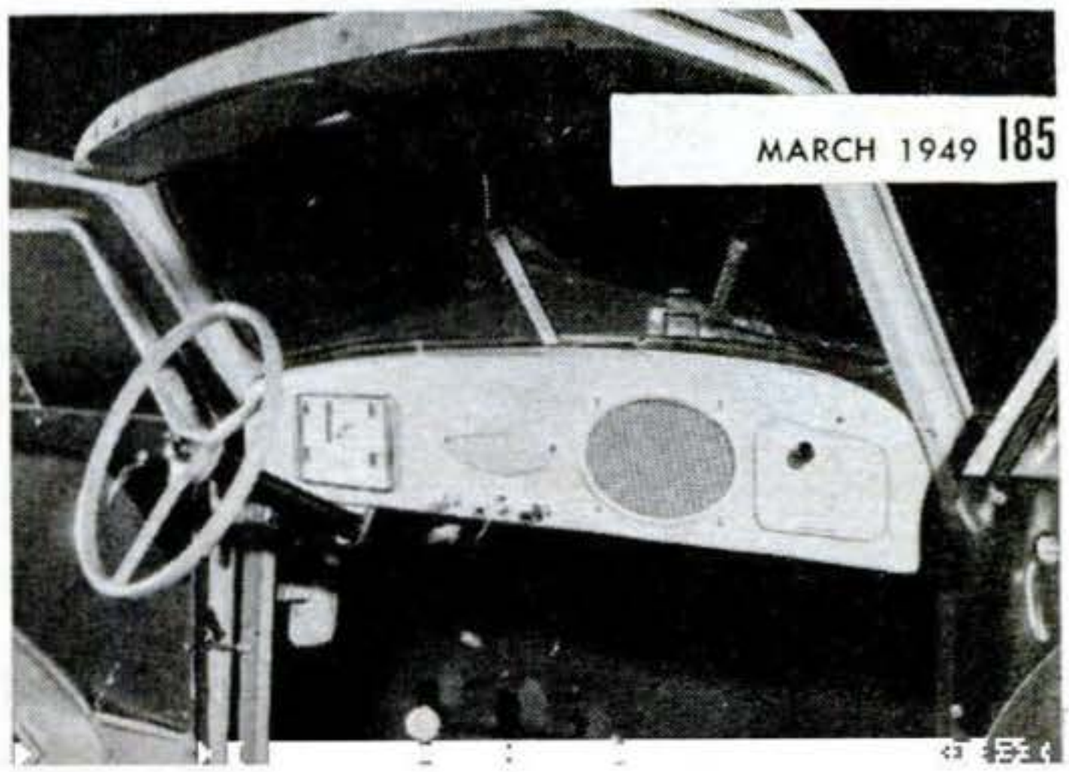


Compression has been upped to 7.8-to-1. Other engine improvements include a larger starting motor and generator, a voltage regulator, an oil-bath air filter, and a ball-bearing fan.

New rotators are claimed to lengthen exhaust valve life three to ten times. Shown here in a full (right) and sectional view, these were adapted from Thompson Products' Roto-Cap®.



Dash instruments are now all grouped in one rectangular panel just ahead of driver. More luggage space is available in all models. It's reached by pulling forward hinged rear seat.



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Sports-Car Fans Ride Four-Wheeled Hobby

Some of their small, foreign-made cars are a dozen years old, but they still look like a million bucks.

By R. P. Stevenson

PS Photos by W. W. Morris

SPEAK of sports cars, and most Americans will think of snappy convertibles from Detroit. These, it is true, are *sporty*, and certainly fine cars. But the sports-car devotee will tell you that they're far from what he's talking about.

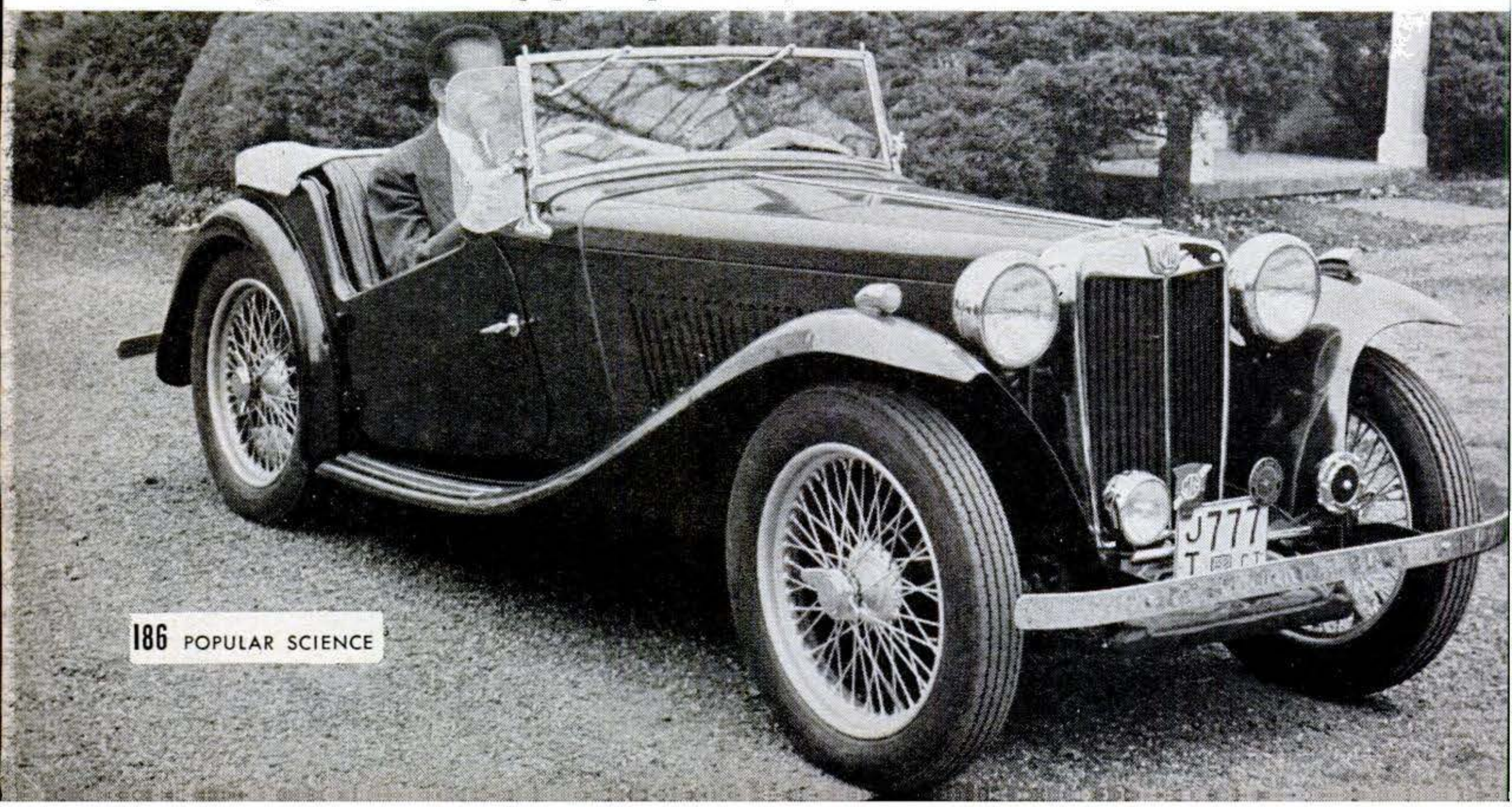
Typically, a sports car is foreign. There is none made in the U. S. Two structural differences distinguish it from the family passenger car—its chassis and its engine.

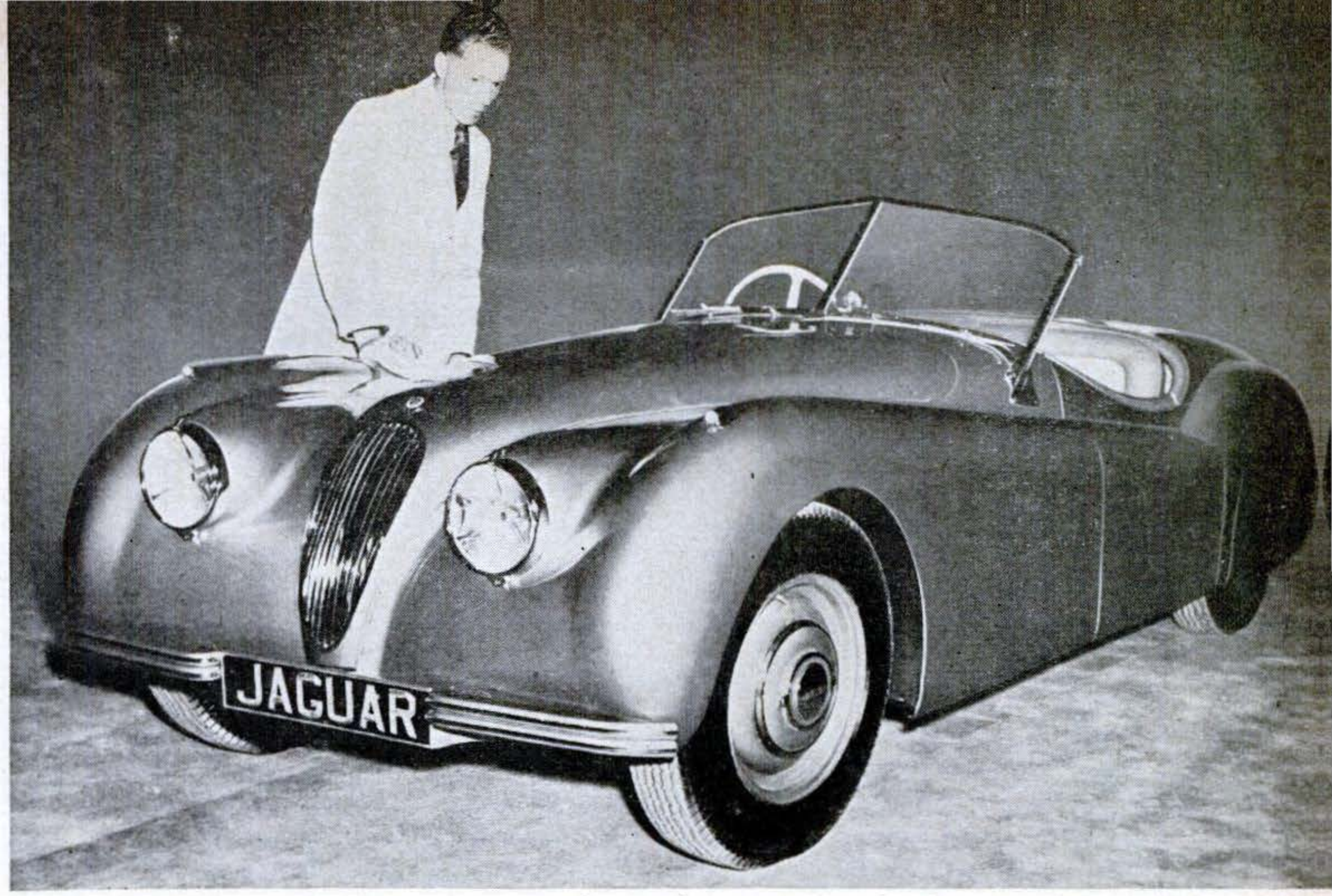
Although small, the engine usually develops more horsepower per cubic inch of piston displacement than anything you've been accustomed to driving. The new high-compression Cadillac engine, for instance, develops only 160 hp. for 331 cu. in.—less than ½ hp. per cu. in. Sports-car engines often give as much as ¾ hp. or more per cu. in.

A sports car is low-slung, and usually has a short wheelbase. Body types vary, though they're mostly open two-seaters. Four-speed transmissions are the rule. Performance is excellent, especially in road-keeping and "cornering" qualities. They'll stay on curves at speeds that would send the family sedan blooping into the guard rail. Springing is hard, uncomfortable in fact, and after a ride you may wonder that anyone would want a sports car.

Their appeal is basically to the art of driving—to the stimulus of skillfully controlling a high-performance mechanism. Take the case of the new two-seater Jaguar, sensation of the recent London auto show. The manufacturer plans to turn out some 2,000 of these in the next year. Within a few weeks

M.G. Midget is one of most popular sports cars, both here and abroad. This is a '48 model.





New Jaguar. This streamlined honey has aroused lots of enthusiasm among U. S. sports-car fans. Two models are available. They're identical except for the engines. One has a 210-cu. in., 6-cyl. engine that develops 160 hp. at 5,000 r.p.m. Top speed is 120 m.p.h. The other has a 121-cu. in., 4-cyl. engine, developing 95 hp. for a top speed of 100. Price: under $5,000.

after the first announcement, orders for 1,600 had poured in from the U. S. alone.

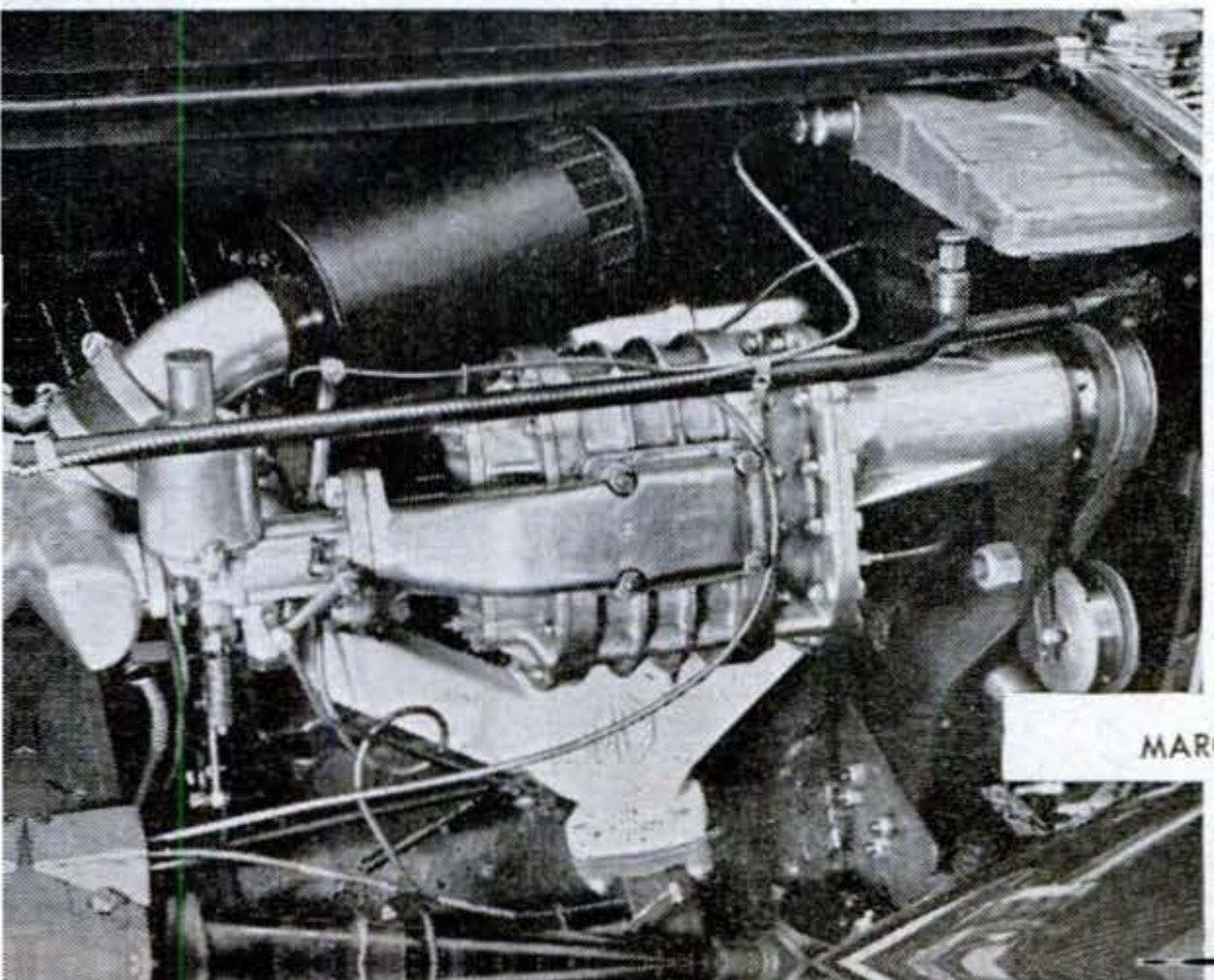
Rated one of the hottest sports cars, this Jaguar is powered by an entirely new engine —with twin overhead camshafts, hemispherical combustion chambers, and 7-to-1 compression. The car will sell in the U. S. for less than $5,000.

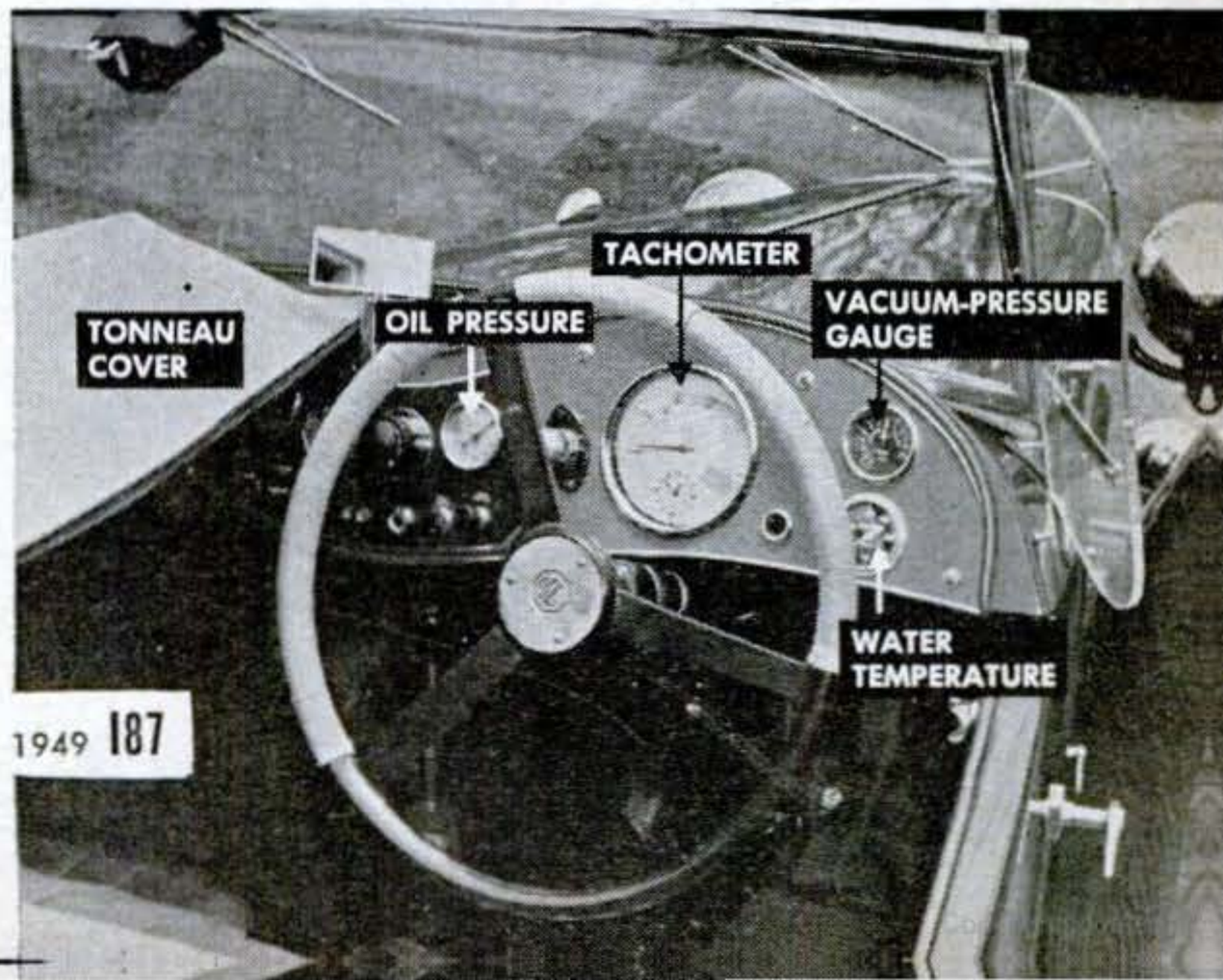
A sports car lies somewhere between the conventional American family car and the high-speed machines that burn up the track at Indianapolis. At times, it may serve just for transportation. But not often. Its main purpose is to give the owner a lot of fun and sport. Developments that eventually find their way to passenger vehicles fre-

British-made, the M.G. costs about $2,400 in the U. S. Below are some features you get.

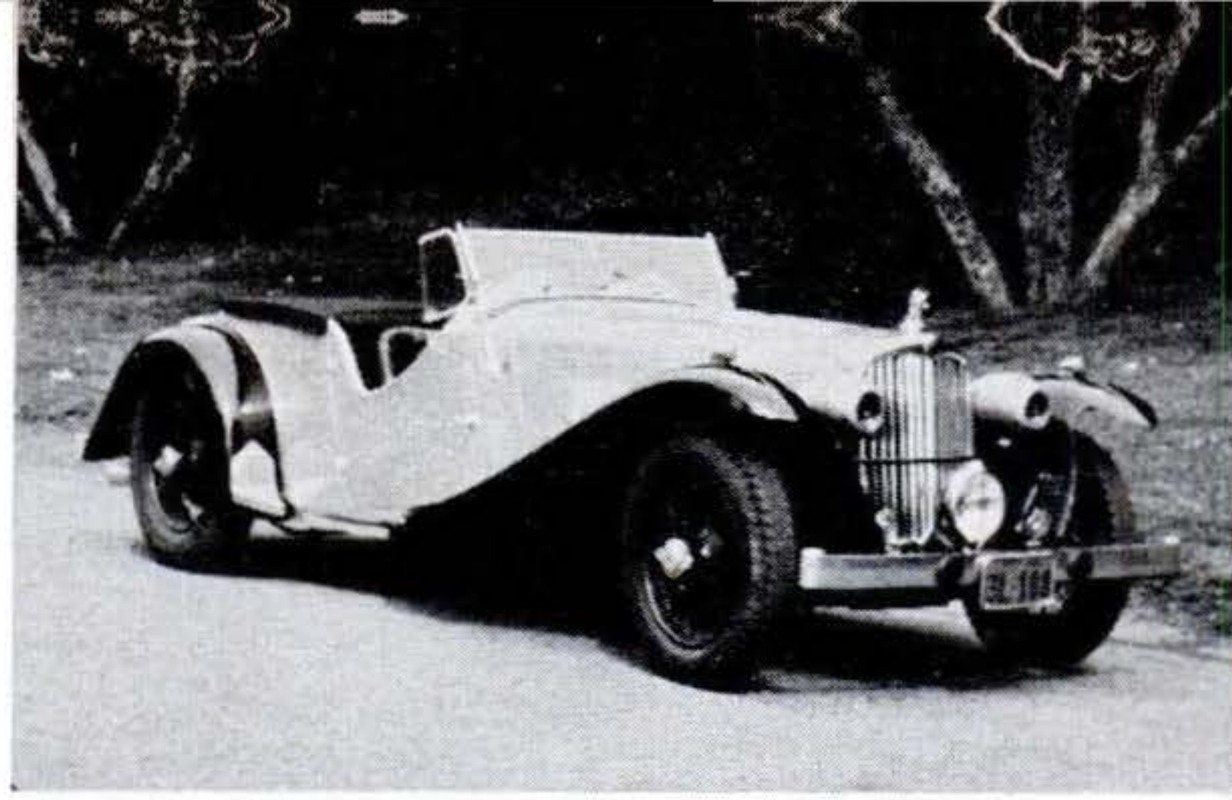
A supercharger gives added power. Notice the air intake just under the hood and the blower housing at center. The 4-cyl., 76.25 cu. in. engine has overhead valves, pushrod operated. The M.G. shown was fast enough to place third in road race at Watkins Glen, N. Y., last fall.

Watch the tachometer—rather than the speedometer. That's usually a rule with sports-car drivers. The idea is to manage the throttle and shift lever so the engine turns at its most efficient speed. In this supercharged M.G. this speed is somewhere around 5,200 r.p.m.





Delahaye. Although this snappy car is a dozen years old, you might think it presents a style for the future. It was one of six fitted with this Figoni & Falaschi body in 1937. The owner designed the bumpers. Its triple-carburetor, 183-cu. in. engine develops 130 hp.



The AC. An all-aluminum body on this 1939 British car gleams like polished chrome. Powered by a 80-hp., 6-cyl. engine, it quickly gets up to 90 m.p.h. It's owned by David Mitchell of Brooklyn, N. Y. Among enthusiasts, an AC often is ranked as the Rolls Royce of sports cars.

quently are given their first tests on sports cars.

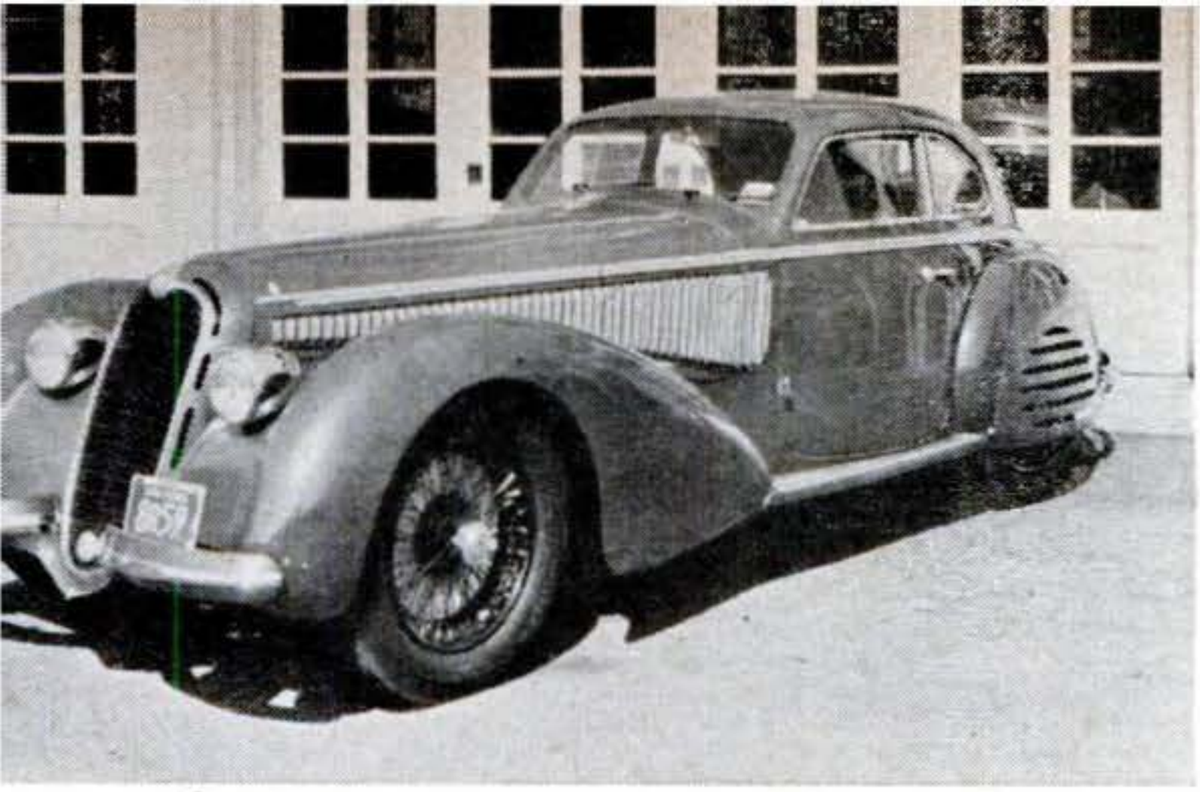
The American demand for this type of car has gone into two channels. On the one hand, you have the hot-rod fans, the lads who take a conventional American car, strip it down, shave off the head, and personally perform a few other tricks to hop it up. When they're finished the result bears little resemblance to the original car.

On the other hand, you have the enthusiasts who own and drive foreign sports cars. These are standard products of the factory from which they came. Owners usually make few changes.

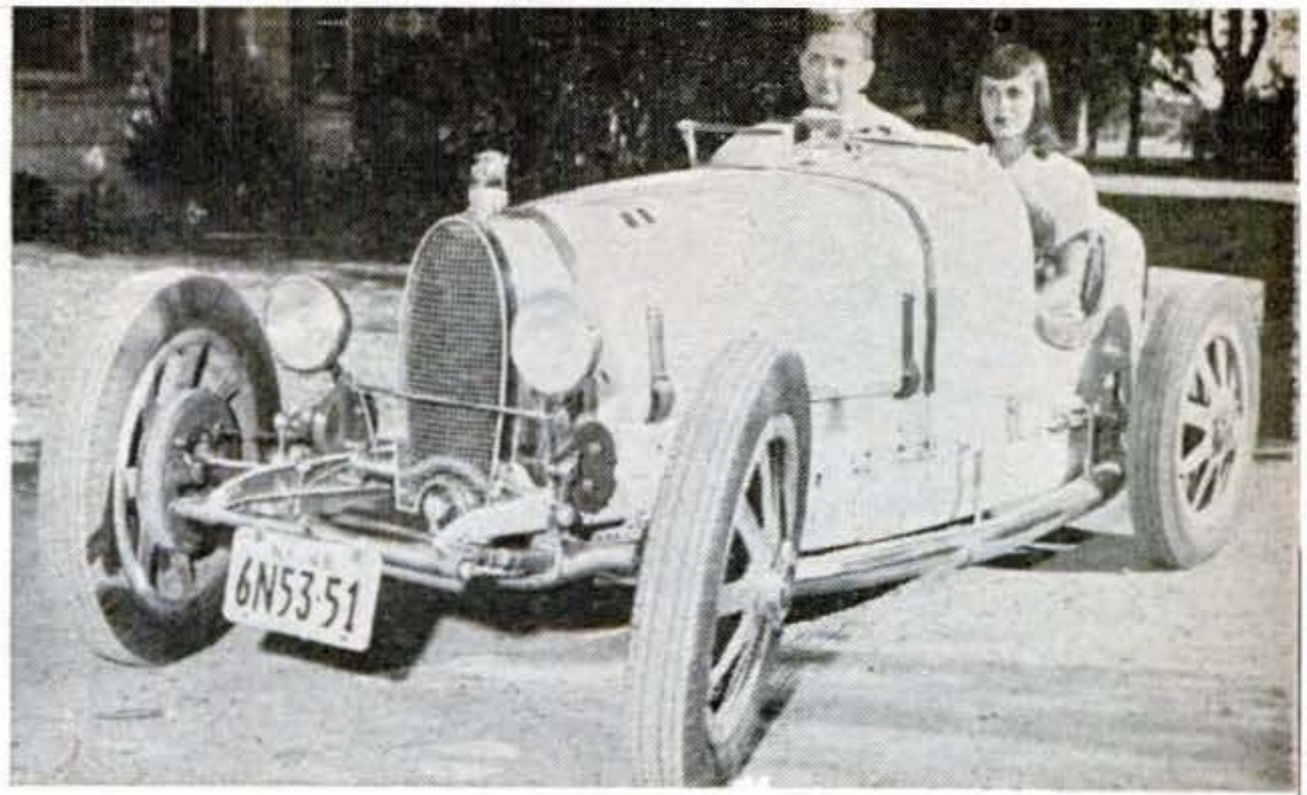
Considering the prices asked now, it may seem surprising that there are so many sports cars in the U. S. Look a little closer, however, and you'll see that a good many are a dozen or more years old, probably picked up secondhand. But age makes little difference. Kept in peak condition, they still perform well—and in their new paint, polished metal, and bright upholstery they look like a million bucks.

Sports-car fanciers here are organized in

Low-slung B.M.W. of this type was 1940 winner of the Mille Miglia, 1,000-mile race in Italy on ordinary roads. In this race, it *averaged* 104 m.p.h. at a gas consumption of 26 m.p.g. The present owner has had it up to 108 m.p.h. on an American highway. Bumpers were added in this country. They're quickly removable by loosening two bolts. At the right—the engine.



Alfa Romeo. F. T. Griswold, Jr., Wayne, Pa., won road race at Watkins Glen, N. Y., in this 1939 model last fall. The 177-cu. in. engine has twin superchargers, develops 180 hp., and has a top speed of 125 m.p.h. Compression is 5.75-to-1. Body is a touring "Superleggera."



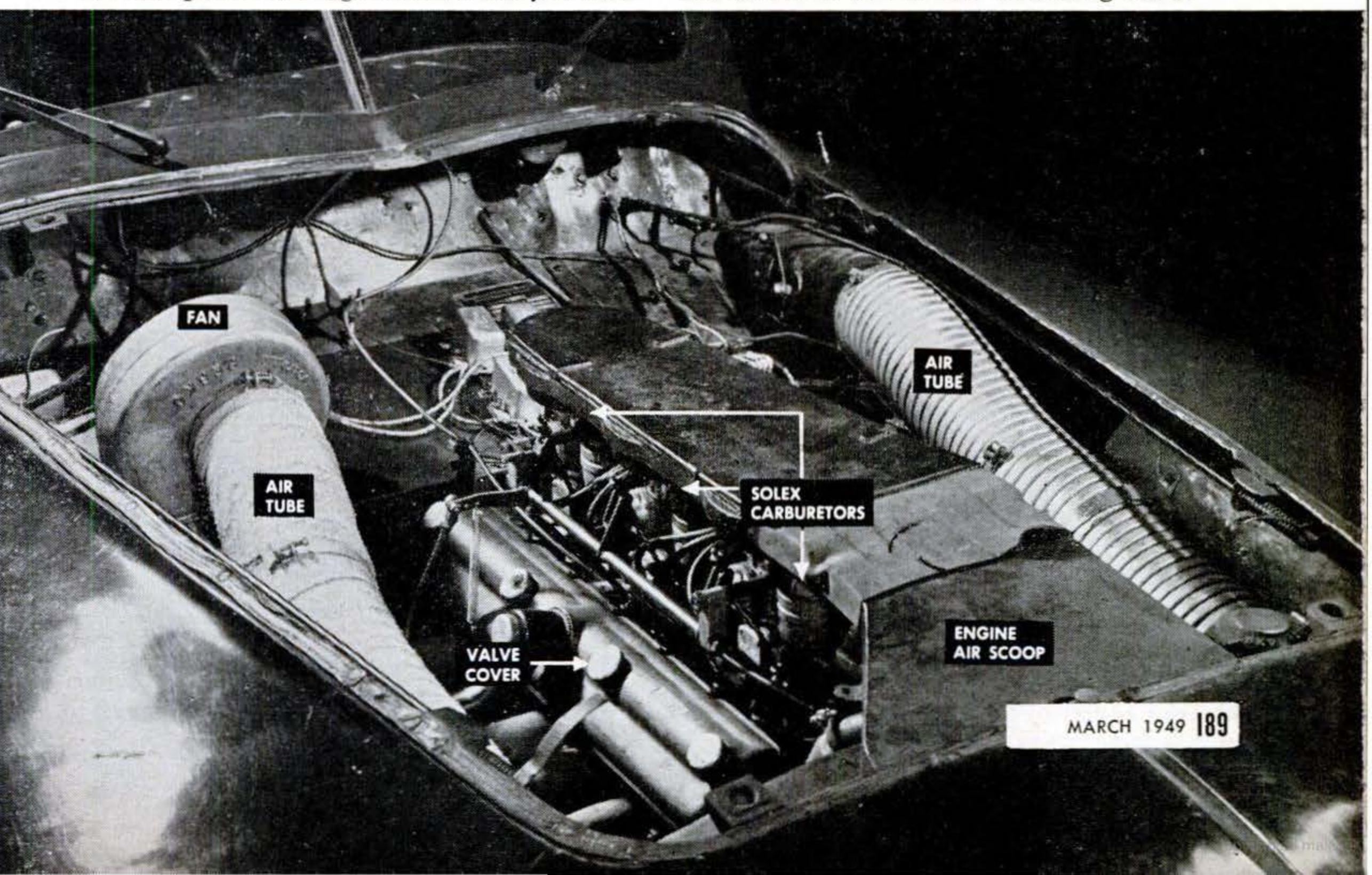
Bugatti. Cartoonist Charles S. Addams owns and drives this type 35 Bugatti. It's powered by a 2-liter (122 cu. in.), straight-8 engine with a single overhead camshaft. Each cylinder has three valves—one exhaust and two intake ones, for better "inhalation."

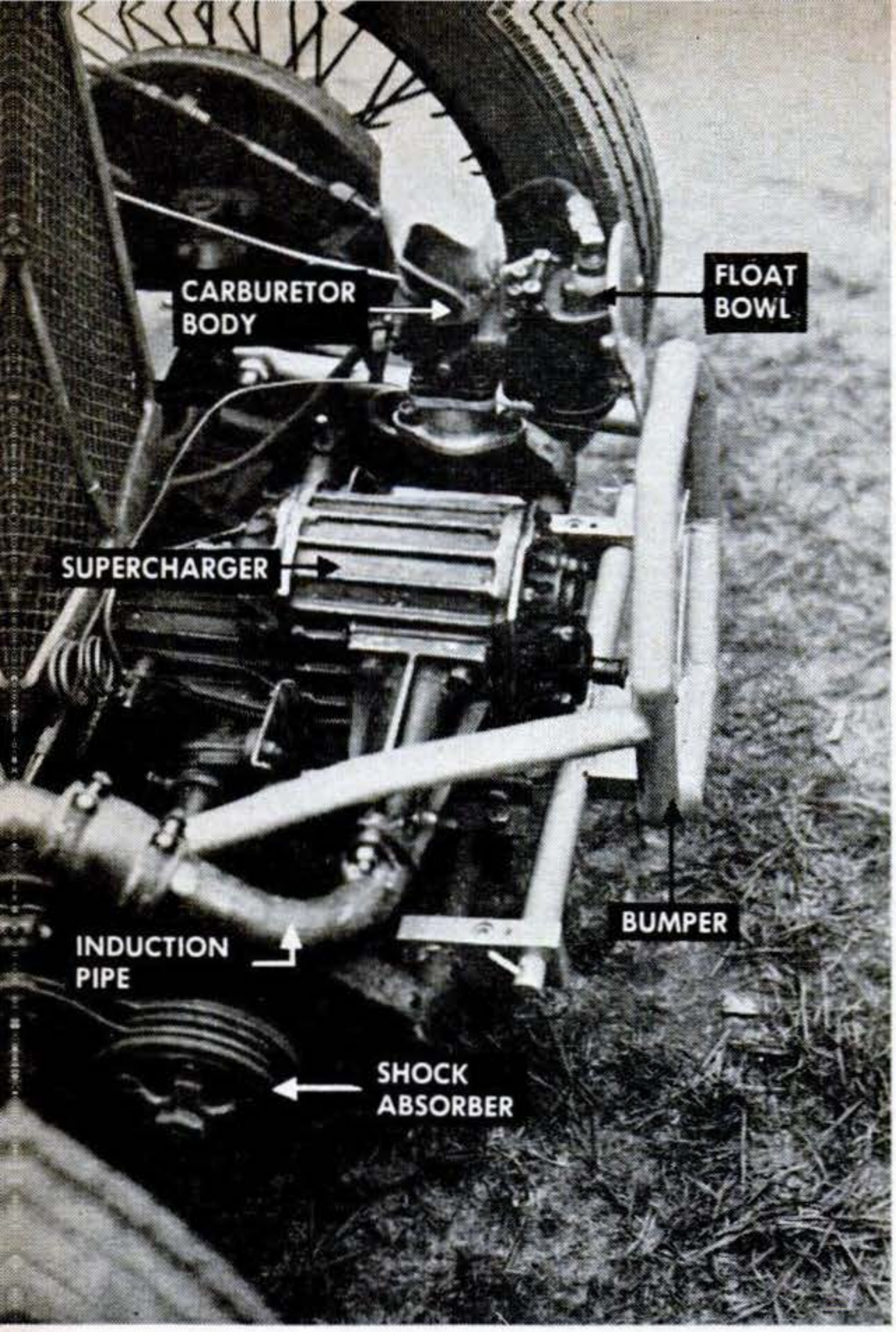
two major clubs—the Sports Car Club of America and the Motor Sports Club of America. Both groups conduct frequent weekend field events. These include hill climbs, acceleration trials, average speed runs, obstacle races, and scratch races. Sometimes there are also informal get-togethers where the talk runs mostly to superchargers, revolutions per minute, and questions like "where can I get that spare part?"

Last fall, the Sports Car Club sponsored a road race, top event in all sports-car activity. Conducted on a winding 6.6-mile circuit at Watkins Glen, N. Y., this meet was the opening move in an attempt to revive road racing in the U. S. This sport thrived here early in the century and still arouses national interest in European countries.

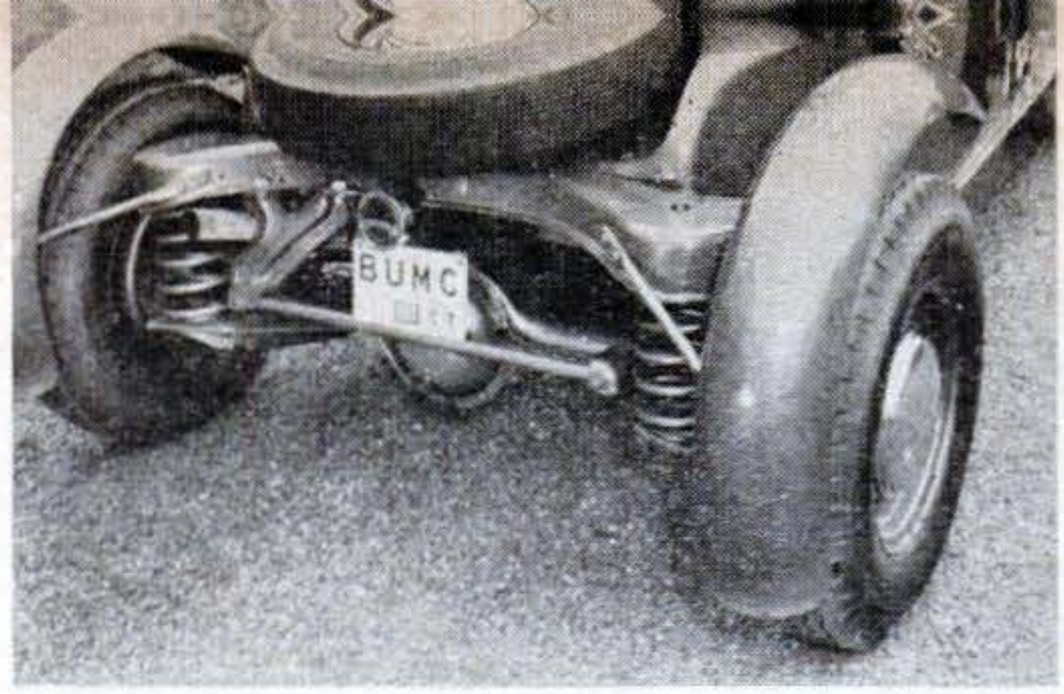
Most sports-car enthusiasts got the habit as kids. They're hobbyists from the toes up. Over the years they've probably owned and traded several cars. A few of the better-fixed keep a full stable of cars. The greater number, however, are one-car men. This they give the constant and loving care that's due a high-performance machine.

Power to spare! The pushrod engine of this B.M.W. has a displacement of 122 cu. in. and develops 140 hp.—well over 1 hp. per cu. in. Put this power in a light chassis and you have lots of speed. The total weight is 1,650 lb., an aluminum body accounting for only 95 lb. Because driver's compartment gets so hot, fan was added to one of two ventilating tubes.

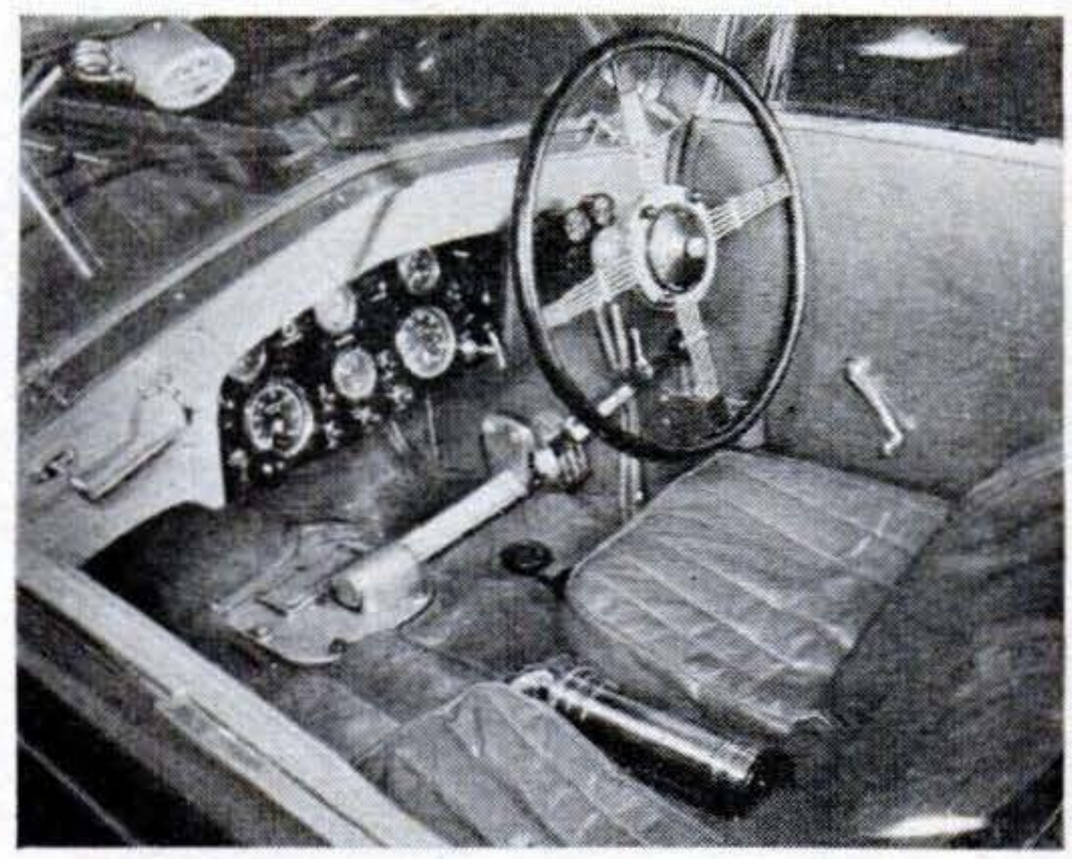




Supercharger installed on 15-year-old M.G. by I. O. Linton, Philadelphia, raised engine's top r.p.m. from 5,500 to 8,000. Blower is driven from forward end of crankshaft. Two electric pumps supply the fuel (gasoline-benzol) to the float bowl. Air enters through carburetor body.

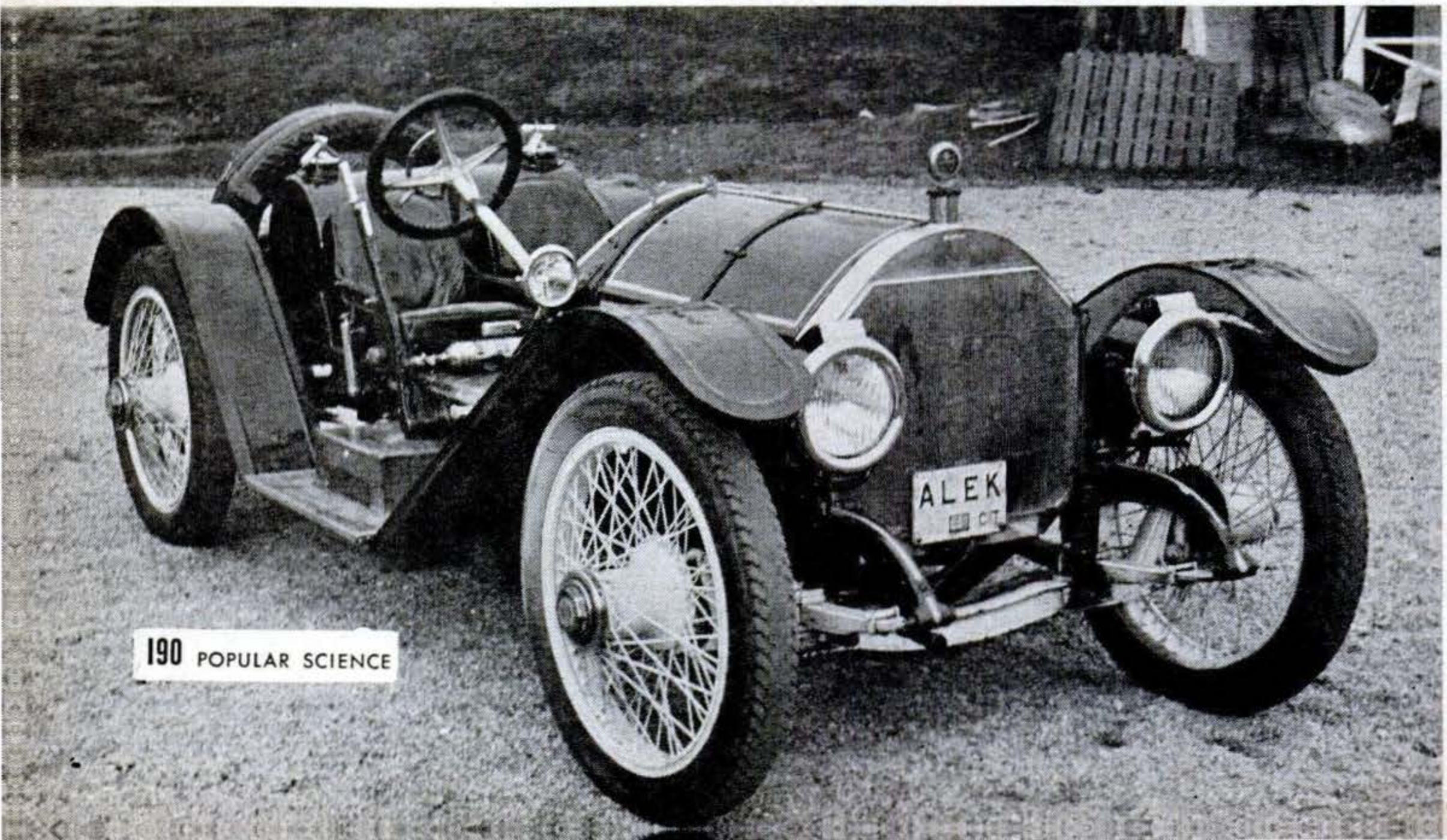


American cars sometimes are revamped to substitute as the sports type. Registered as a Bu-Merc, this bobtailed hybrid consists of a 1939 Buick chassis and engine with a Mercedes body. Engine was moved back 6½", lowered 2½". Special head gives it 9½-to-1 compression.



Invicta 100 owned by Ralph Stein, of Roslyn, N. Y., has knurled knobs on floor under wheel to adjust shocks, two dials ahead of driver showing how they're set. Big knob at left end of panel works hand gas pump. The car also has twin electric pumps. This is a 1935 model.

In the early days, American makers produced a number of fine sports cars, among them this 1912 Mercer Raceabout. Restored to original condition by Alec Ulmann, Old Greenwich, Conn., it still is capable of a lot of speed—more than 80 m.p.h. It's powered by T-head engine.



Mechanics and Handicraft

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Cleaning a Typewriter PAGE 214

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Machine Cuts Drafting Time PAGE 218

Improve Your Midget Radio PAGE 230

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Cleaning and tuning up a typewriter looks simple when an expert does it. Page 214

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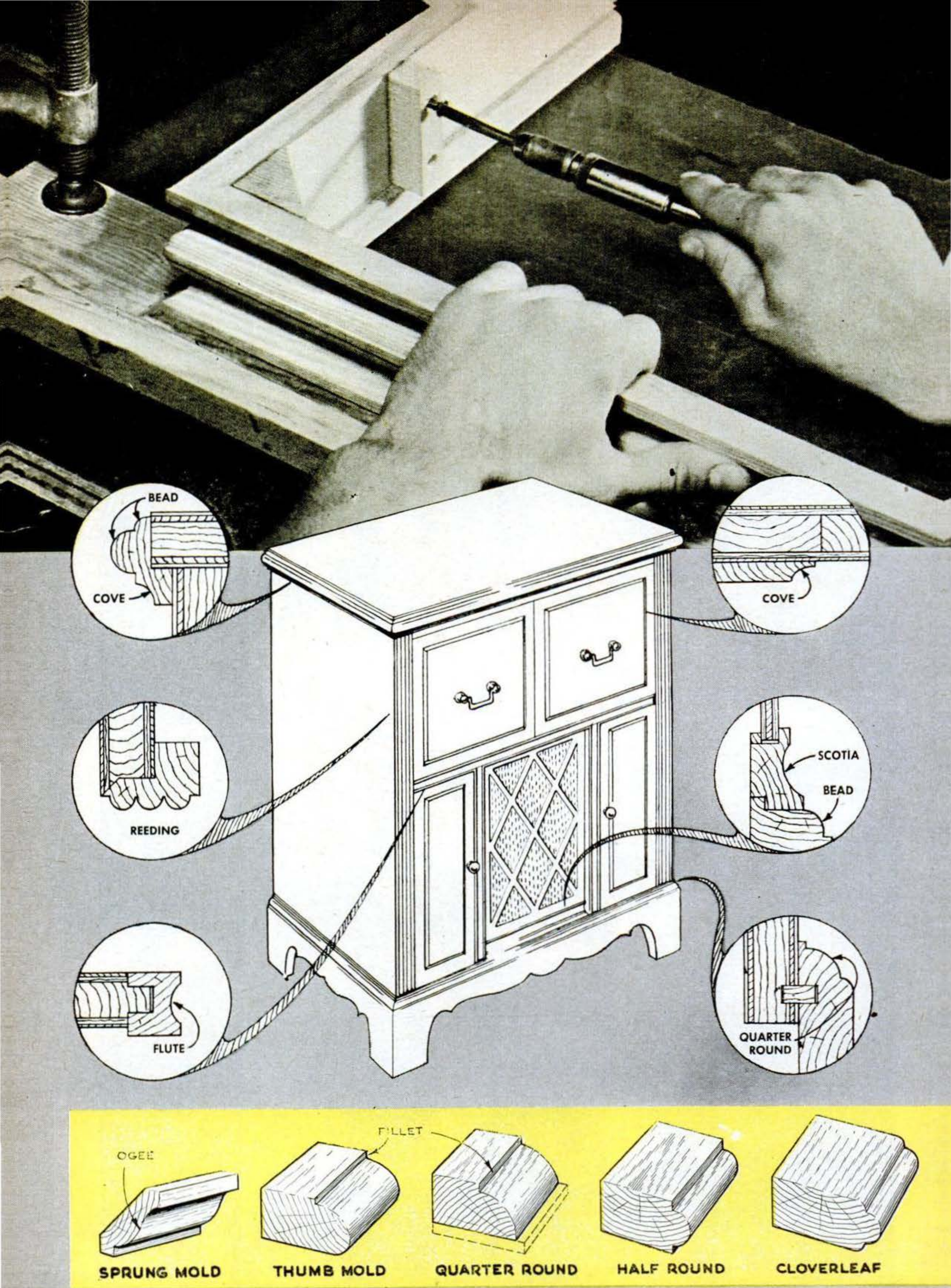


Common moldings. A sprung mold, shaped on the face of a thin piece, saves stock in corners.

Moldings Make the Difference

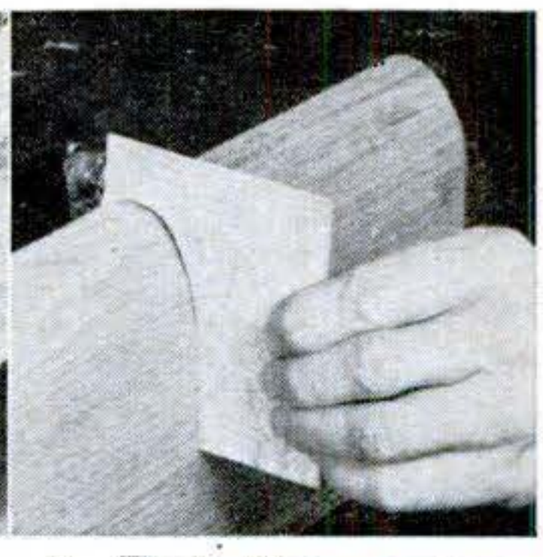
Whether you use them to hide joints and edges or for ornamentation, shaped surfaces enhance your work.

By Edwin M. Love

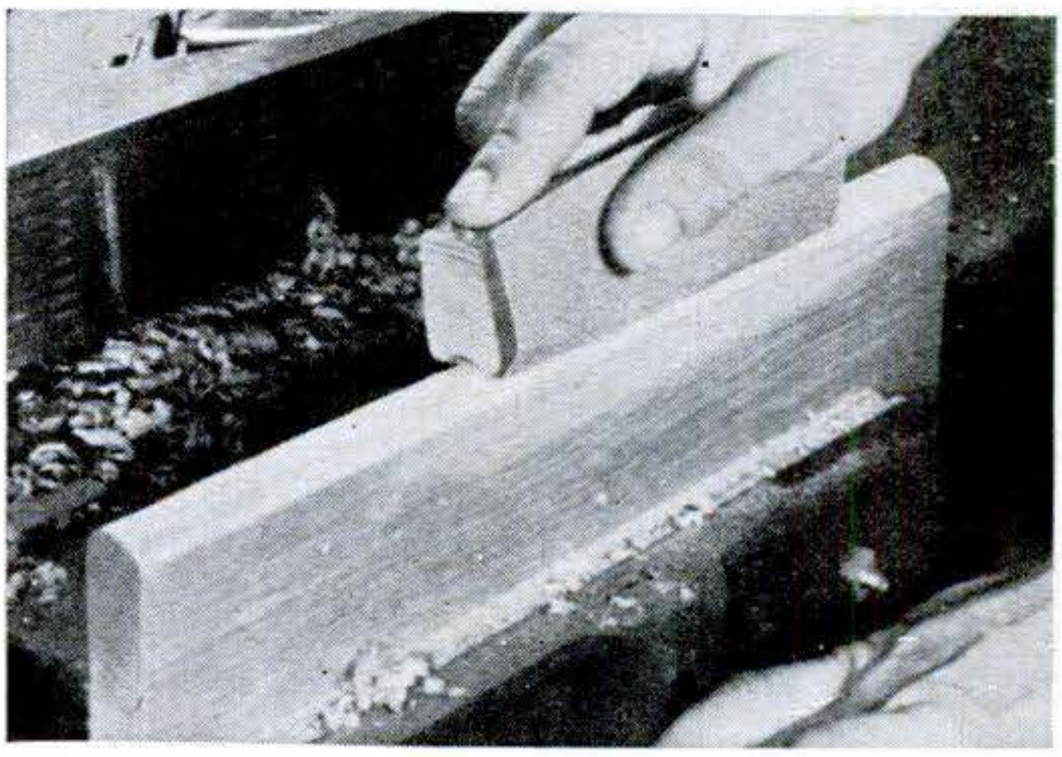
THERE are many modernists who use the word "molding" as a cross between an insult and an epithet. For them, any furniture ornamentation beyond the simplest and most functional belongs only in the history books. Most of us can join them in their admiration of simplicity and forthright construction, but tradition is a sturdy thing. We still respect the work of craftsmen like Chippendale, Jacob, and Hepplewhite. Try to picture their masterpieces without moldings!

Let's not forget, too, that moldings can be functional. An applied bead and cove conceals the raw edges of a plywood table top, a quirk on a hanging stile camouflages the joint between it and the door, and a bead on a drawer front helps conceal the sliding clearance. The drawings on these pages illustrate other applications. Whether

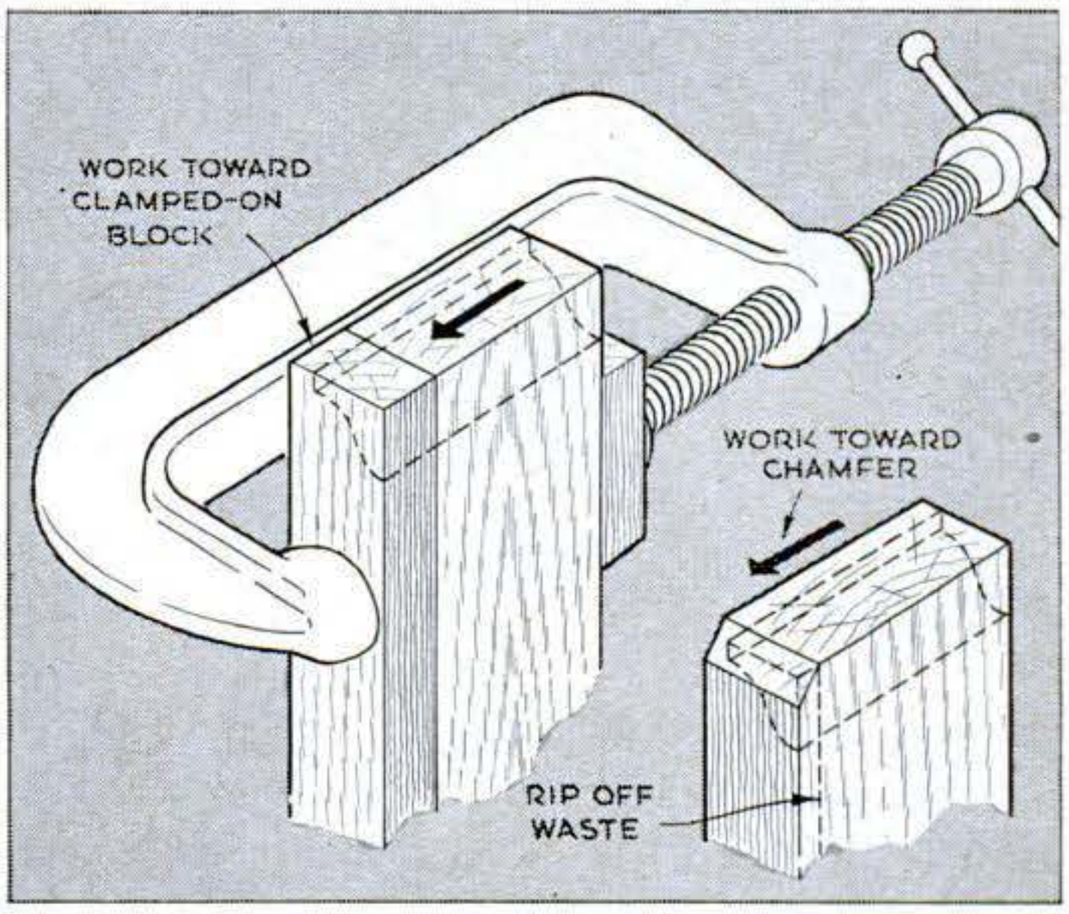
1. Rough a thumb mold with a hand plane by cutting corners repeatedly.



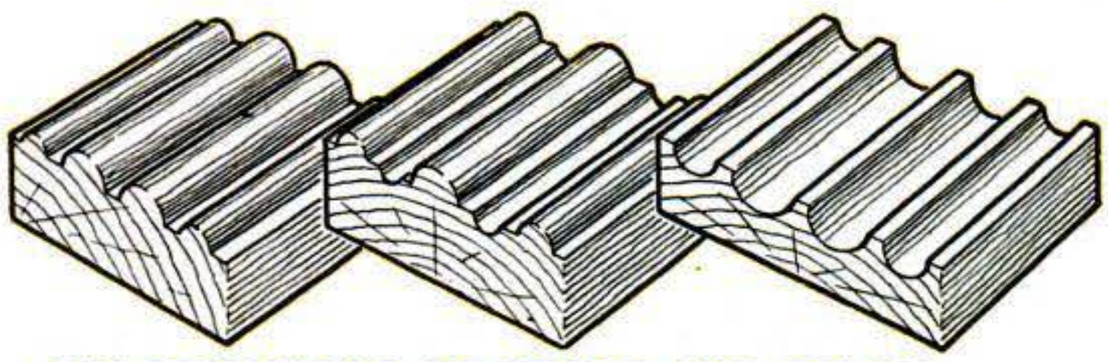
2. Test the contour as you work with a cardboard template. Use it to mark ends.



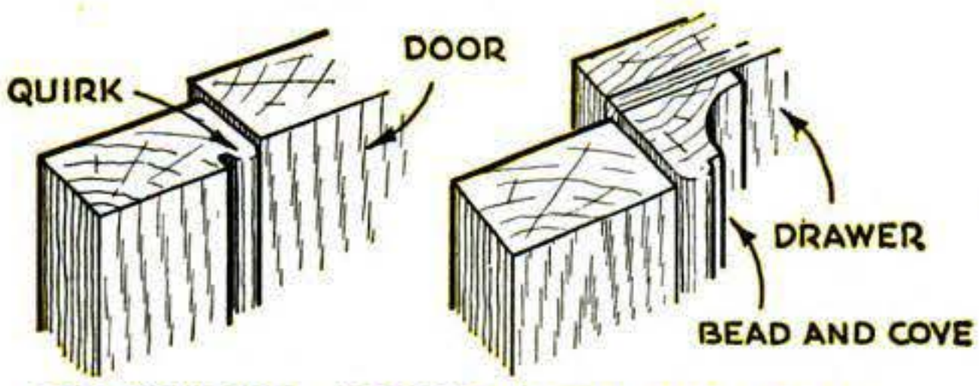
3. A rubber, or sanding block shaped to a reverse profile of the mold, smooths the edge.



4. In molding end stock, splintering can be prevented by either of the two methods shown.



COMBINATIONS OF BEADS AND COVES



DISGUISING JOINTS WITH MOLDING

Combinations give moldings variety. Right, use molds to conceal door and drawer clearances.

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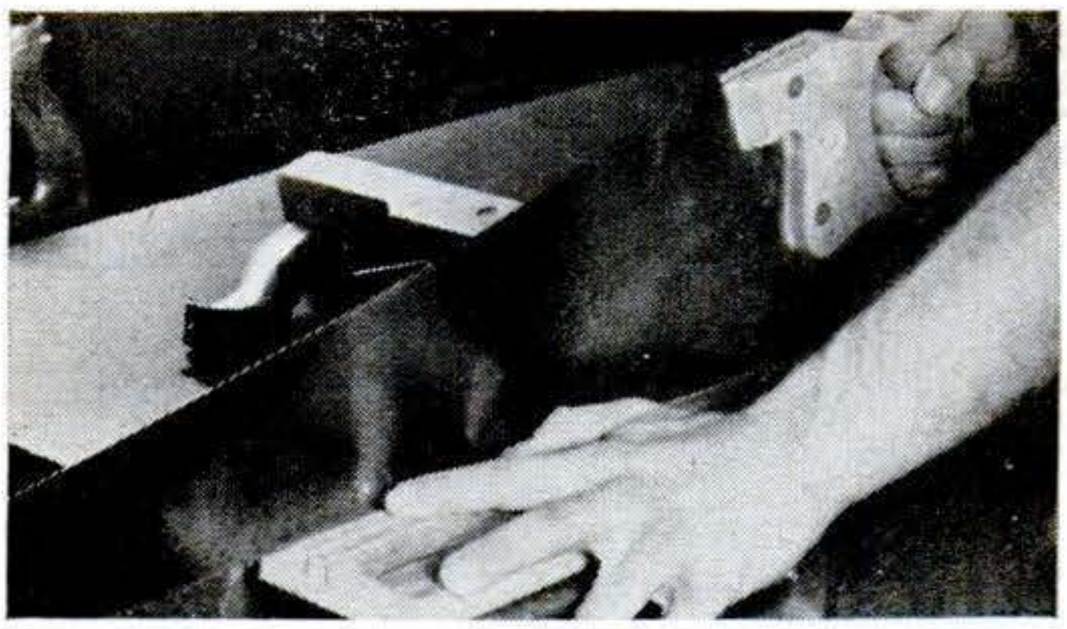
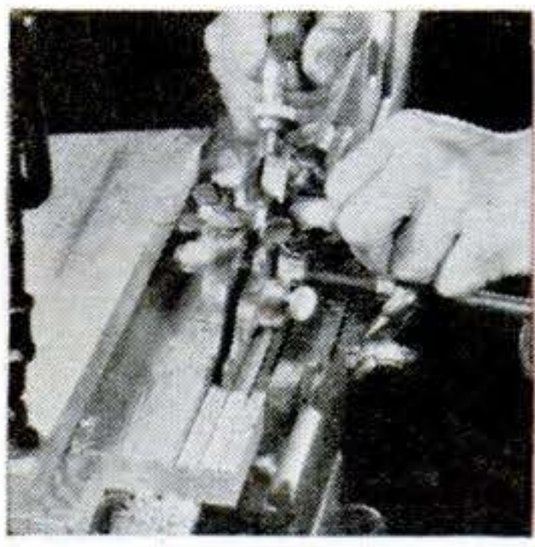
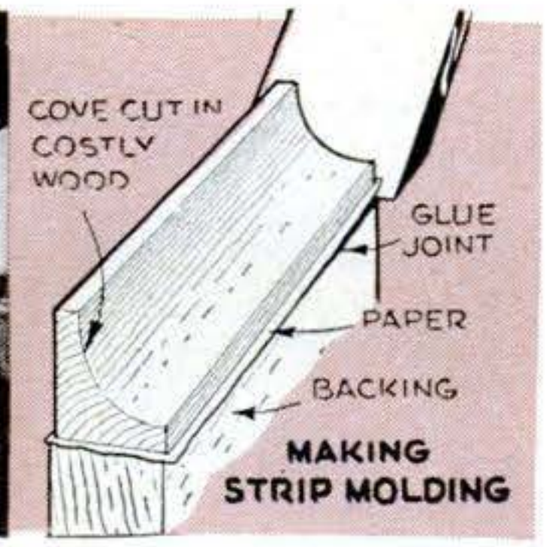


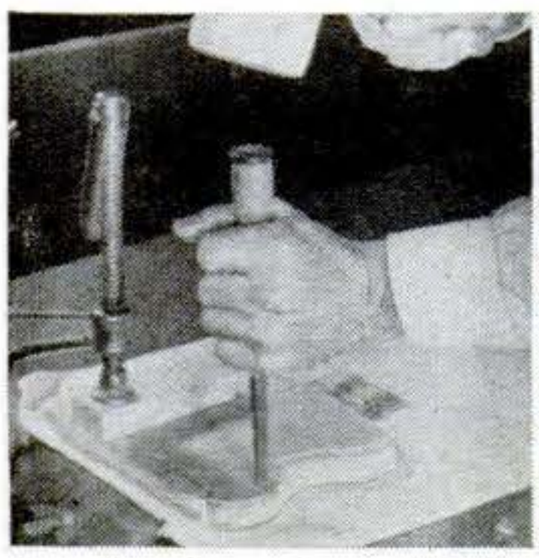
5. Reeding, or beads set close together, is made by scoring between the beads with a saw.



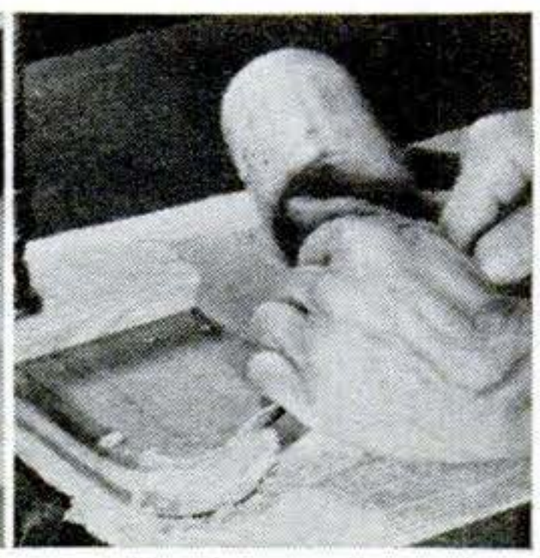
6. Combination planes will make a variety of molds. Irons come in many styles.



7. Save costly wood by gluing a thin strip to a backing. Split it off after making mold.



8. Carving is called for in molding curved edges. Vertical chisel cuts mark the outline.



9. Horizontal strokes —with bevel up—level the molding to depth. Trim with bevel down.

your specialty is building period furniture or smaller projects such as boxes, bookends, and novelties, you'll find plenty of use for moldings.

Never mind if you don't own a shaper. You can make moldings by hand. Take the thumb mold, for example. This simple elliptic contour, while especially used in provincial furniture, is pressed into service in many other structures. It gives lightness to a heavy table or bench top without resorting to projecting angles that are soon worn down. The tools needed to make it are a plane, sandpaper, and one or two rubbing blocks hollowed to fit parts of the curve.

Cut a cardboard template (Fig. 2) and use it for drawing the curve on the ends of the piece and also for testing the profile as it is being shaped. Rough the molding with the plane, as in Fig. 1, cutting chamfers and repeatedly planing down the corners. Accuracy depends on how steadily you can hold the angle of tilt throughout the stroke. Machinelike precision, however, isn't always necessary. Much of the charm of handmade provincial furniture lies in subtle irregularities of moldings and surfaces.

Use of a contoured sanding block, or rubber, is illustrated in Fig. 3. Press a piece of coarse sandpaper over the planed molding, and fold the sides up around the block for easy gripping. For fine sanding the waterproof type of abrasive paper may give best results, as it has a flexible backing that will follow the curves of the mold and rubber better than the stiff-backed abrasive paper. Use it dry, of course.

Shaping a semicircular bead on the edge of a board is but a step removed from making a thumb mold. Fit the rubber to the arc of the circle. Often a thumb mold or bead or quarter round is offset by rabbeting to form a fillet at one or both surfaces of the piece. You'll find a rabbet plane handy to work near the inside corners, and a cabinet scraper is good for cleaning off ridges preparatory to sanding with a rubber. Make the cloverleaf design by shaping quarter rounds on the fillets and a half round on the tongue.

A table or cabinet top requires molding of the ends as well as edges. It is good policy to shape the ends first so that if any splintering occurs when the plane or chisel exits at the far edge it can be cut away when the edge is shaped. It is sometimes possible to work from both edges. This minimizes splintering, but because the stroke isn't continuous there may be a tendency to crown or gouge the edge.

Two other methods for preventing splitting are shown in Fig. 4. In one the edge is left rough, and an allowance of ¼" or more is made for trimming. The arris on this waste piece is nipped off in a chamfer, and there is no danger of splintering if you work toward the chamfer. Where nothing can be spared from the width of the work, the other method is useful. Clamp a buffer block to the far edge and work the mold through it. If there is any splintering it will be in the waste block and will do no harm. Make sure the block is clamped tightly.

Moldings can be worked on the edges of plywood if the piece is to be painted, but

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there will be end-grain to seal and holes to be filled in some of the plies.

Reeding—or parallel beads set close together—flutes, or combinations of them are sometimes used to ornament surfaces of cabinet fronts. These can also be made with hand tools. For reeding, the first step is to score between the beads with a saw as shown in Fig. 5. Then chamfer with a rabbet plane and with light chisel cuts along the sides of the beads. Finish with the rubber. You can exercise your ingenuity and designing skill in combining small and large beads or coves.

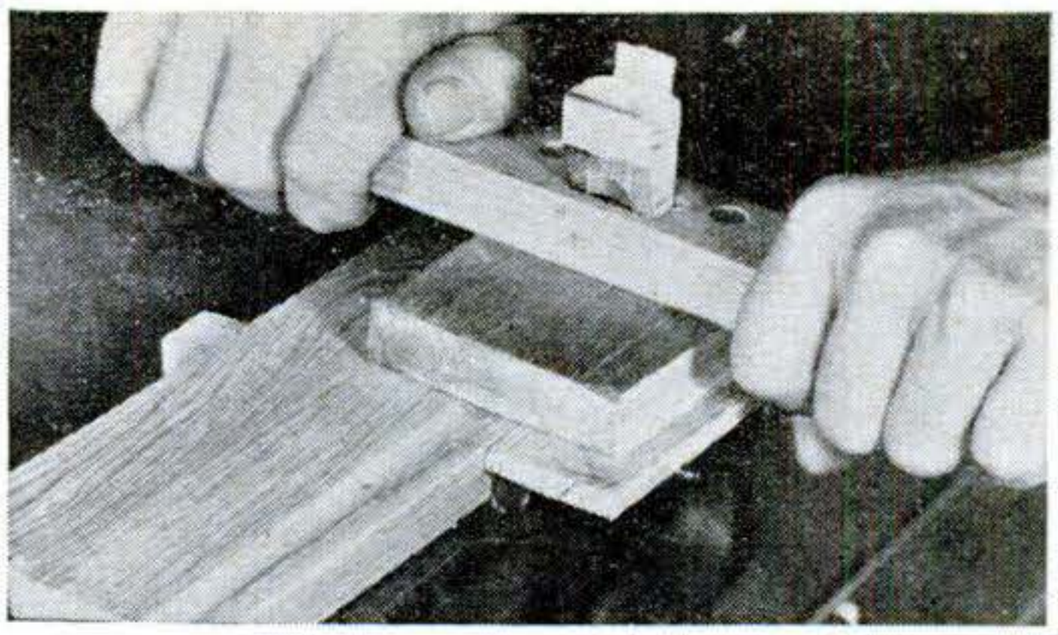
If you own a combination plane or can borrow one from a friend, you can make a wide variety of moldings with little difficulty. Extra blades of various patterns can be purchased. Use of the plane is illustrated in Fig. 6. Insert a bit, align the spurs with its edges, set the depth gauge and fence, and plane to depth. A trial cut will indicate the thickness of the shaving you should attempt. When one bead is made, shift the fence to bring the bit into position for the next. Use a round-nose cutter for flutes, and turn the spurs to a noncutting position. If beads are combined with flutes, plow grooves between the beads before working them and the flutes to shape.

Strip molding should be cut in the edge of a board and then sawed off after it is completed. To economize with expensive hardwood, glue the strip to a backing board with a ribbon of paper between. Make the molding; then split off the strip by driving the edge of a chisel into the paper joint (Fig. 7).

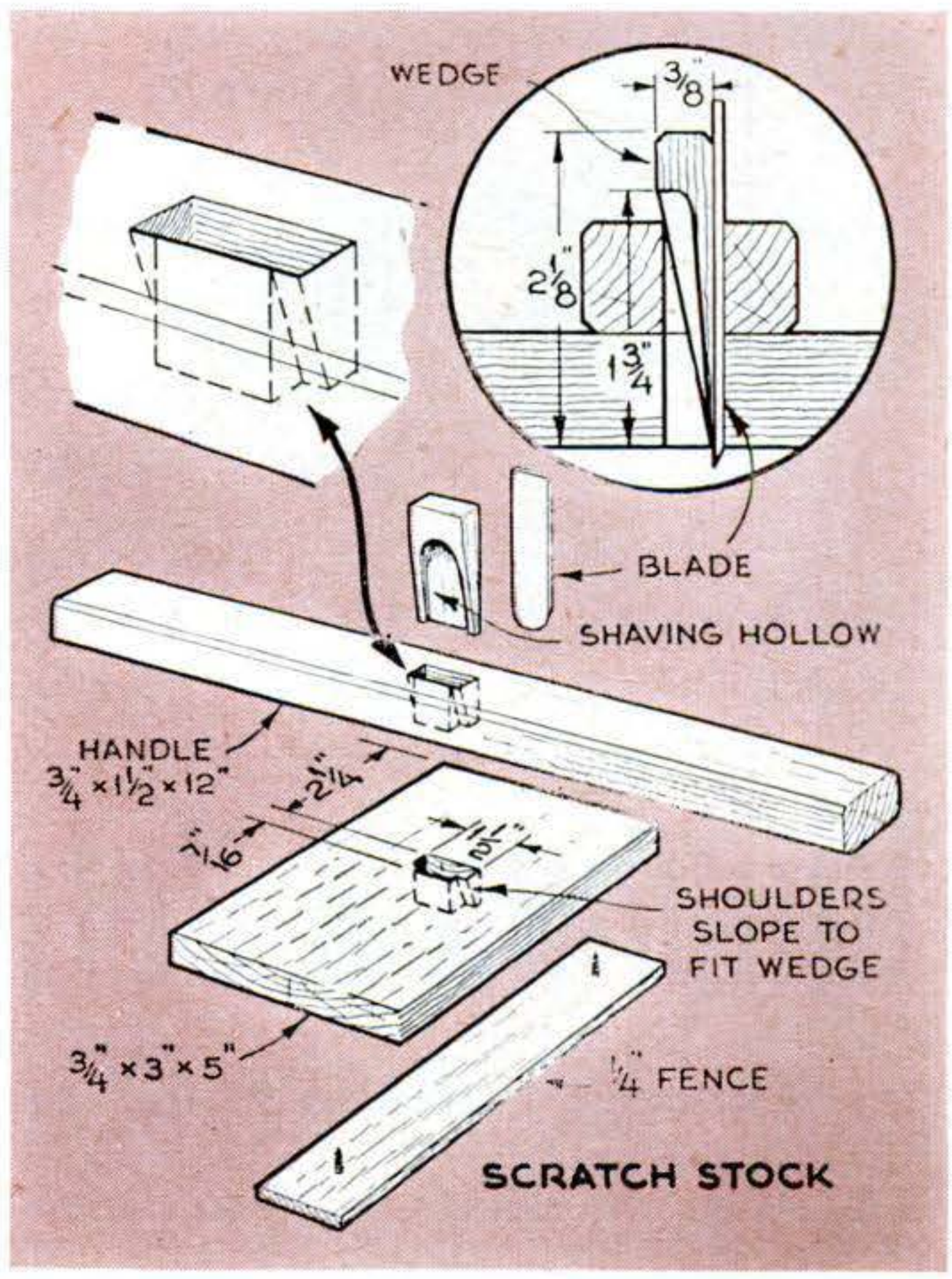
You can save material in large moldings by treating the face of a thin piece as if it were the edge of a heavy section or triangle. Such a molding is termed "sprung," and finds wide use in inside corners and built-up assemblies such as cornices.

When a curved edge is to be molded, you'll have to resort to carving. The first stage in shaping a quarter round flanked by fillets is pictured in Fig. 8. Part of the molding has already been made in order to show the effect. Firm in the outline with a chisel. Level the molding to shape with horizontal strokes, and finally trim the round profile with the bevel of a flat chisel as in Fig. 9. It is necessary to work with the grain. A cardboard template is a big help in sanding the work.

One version of the old-time scratch stock—a tool for scraping moldings—is shown in



10. Scratch stocks with interchangeable blades can be used for making many different moldings.



11. The wedge as well as the slots in the body and handle is hollowed so shavings can escape.

Fig. 10; construction details are given in Fig. 11. The blade is ground or filed to shape and whetted sharp. An old cabinet scraper or saw blade furnishes the material. Clamp the blade with the wedge. The holes in the stock and handles are tapered to fit the wedge, and are relieved in front to allow shaving clearance. The wedge (which is also hollowed so that shavings can escape) bears on the shoulders of the openings. Fine adjustment of blade depth is not necessary, since the tool can be rocked forward for starting cuts, and you can slide it on its sole when the cut deepens. A tap on the upper end of the blade drives it down for a deeper cut. END

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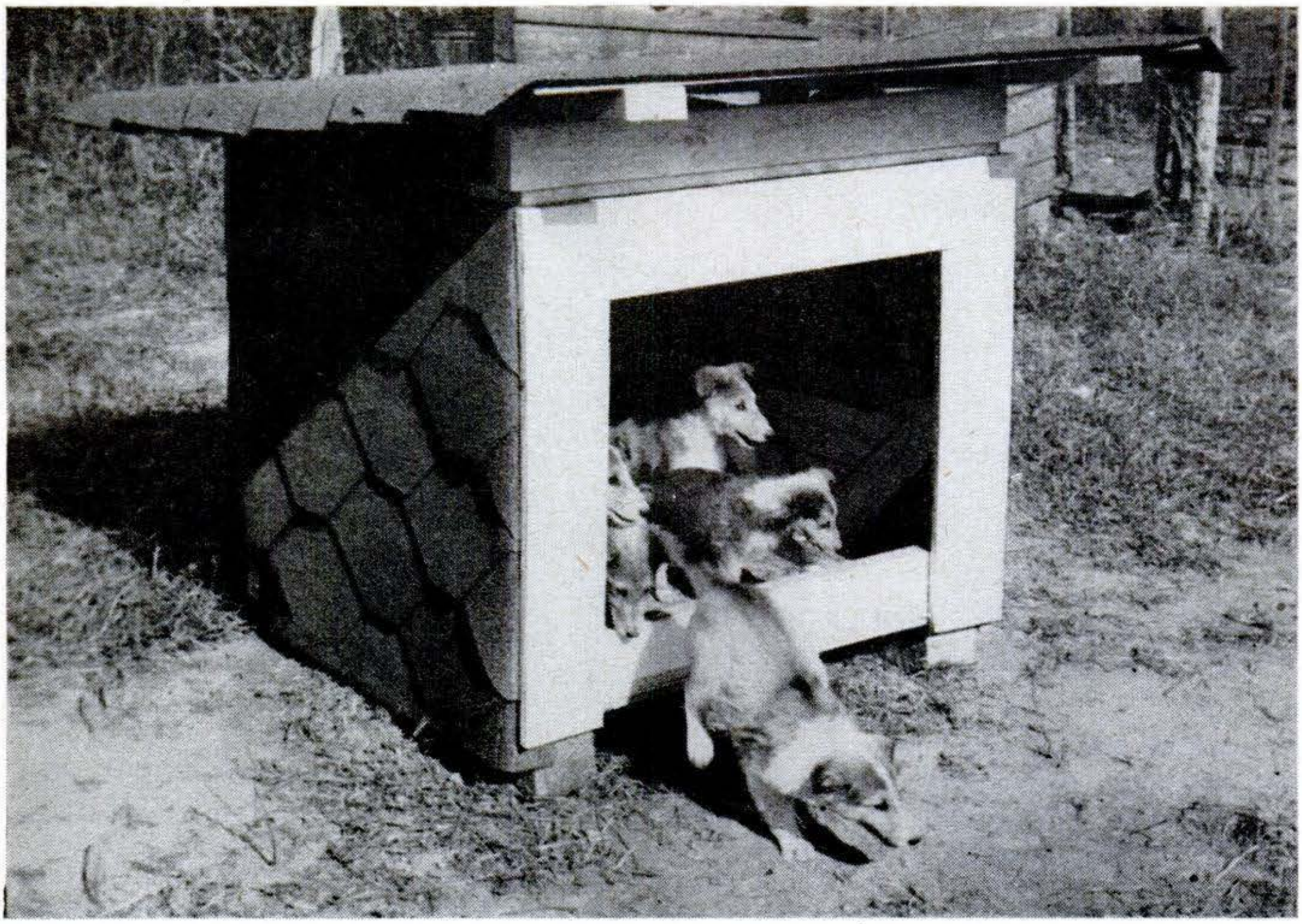

Better kennels mean healthier dogs. Well insulated, this one is dry, warm, and easy to build.

Building a Better Doghouse

By Thomas William Helm III

WHEN you solve your dog's housing problem, do it right—whether he's just a pooch that followed you home or a pure-bred that cost you a few hundred dollars.

The first question that usually arises is how large to make the house. Here's a rule I've followed to answer that question: Build the house as wide as the full-grown dog is long, with the depth one and a half times the length of the dog. Make it high enough for him to stand up comfortably. These proportions permit the dog to stretch out in hot weather and yet keep the house small enough so his body heat warms it fairly well in cold weather.

Proper location of the house also is important. The east or south side of a building or a board fence is a good spot. Such shelters help keep the house cooler in summer and less exposed in the winter.

Double-thick flooring with a sheet of tar-paper between will keep out drafts and dampness. Nail the subflooring to four-by-fours and rest them on bricks. That will raise the house high enough so air can circulate to dry the soil under it after rain.

Build the frame of four upright two-by-fours and top them with four horizontal two-by-fours. Brace all lower corners to increase strength. The next step is the roof and ceiling. Fit the ceiling boards together tightly and slope the roof for quick drainage. The space between the roof and ceiling will help protect the interior from the sun's heat. Any type of shingles may be used to cover the sides and roof. Leave the front of the house completely open after facing it with 4″ boards. This means better air circulation in warm weather. In winter, hang a burlap curtain in the opening to keep out drafts and rain or snow.

For bedding inside, avoid newspapers and rags—they hold dampness. Cedar chips or shavings are best.

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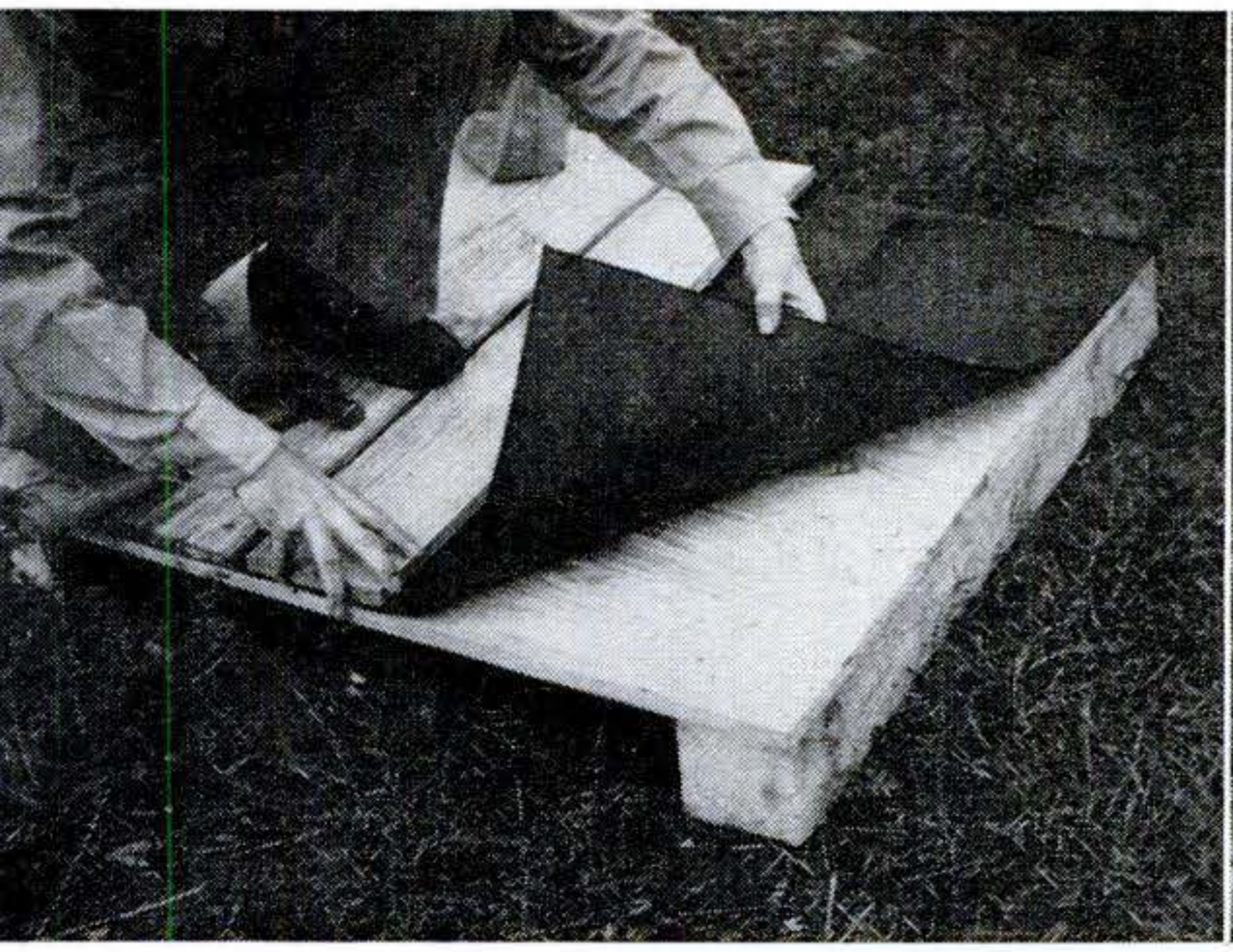
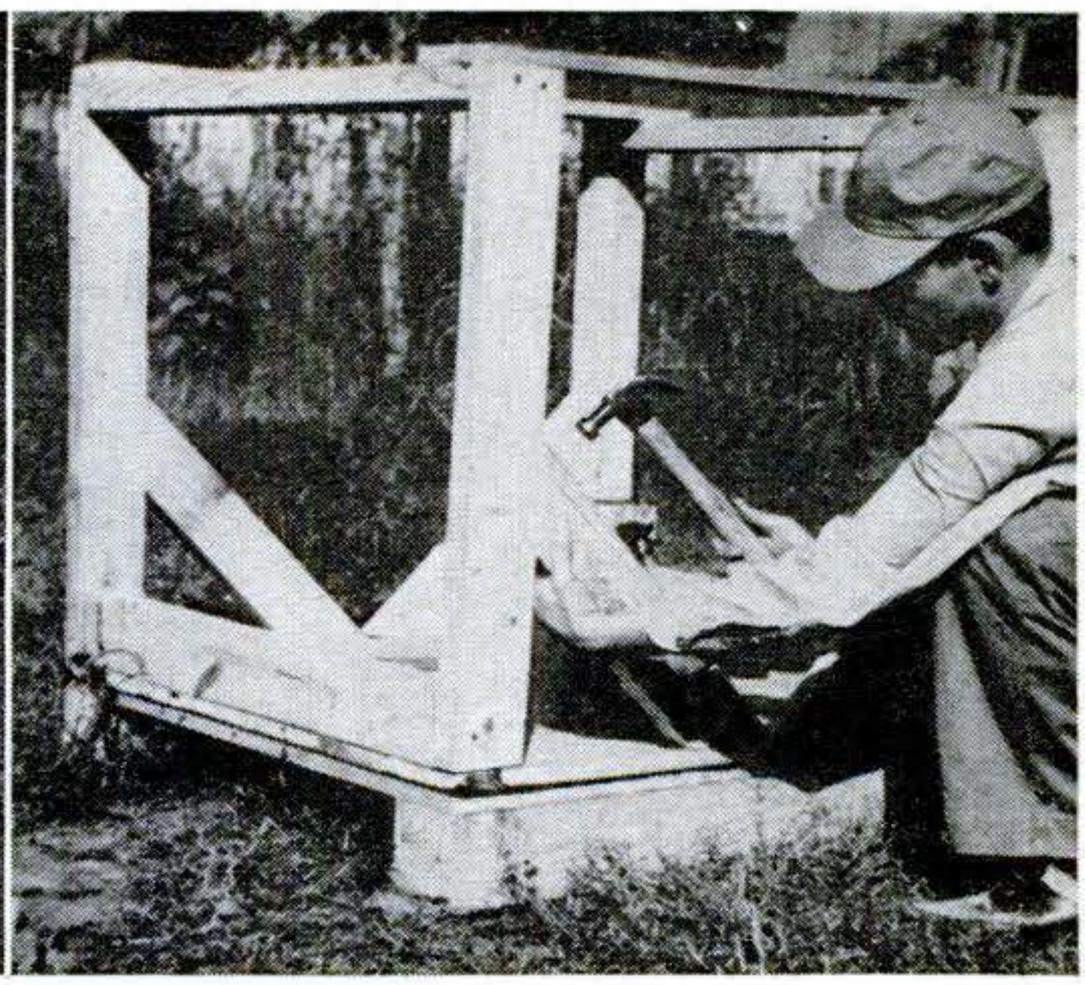
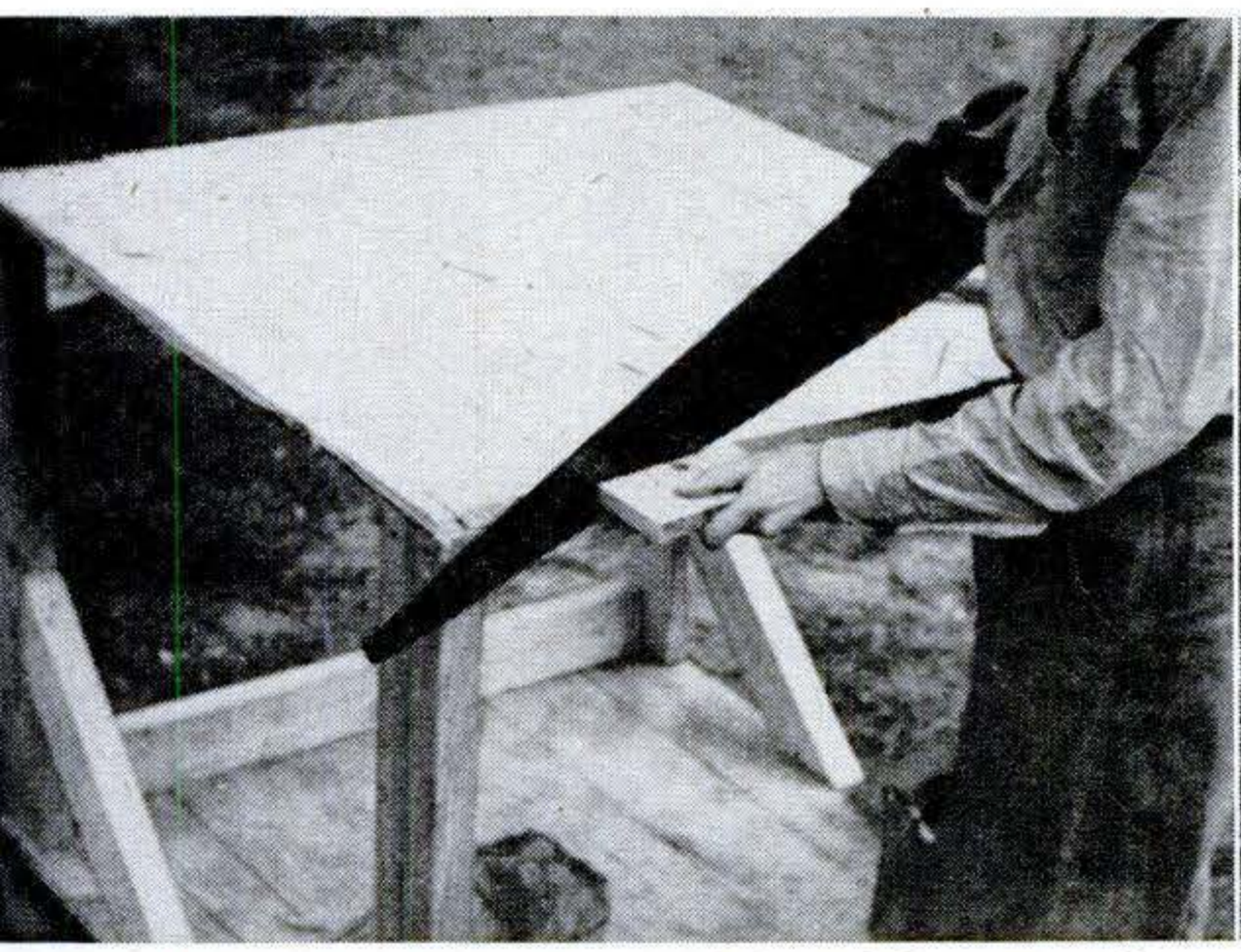


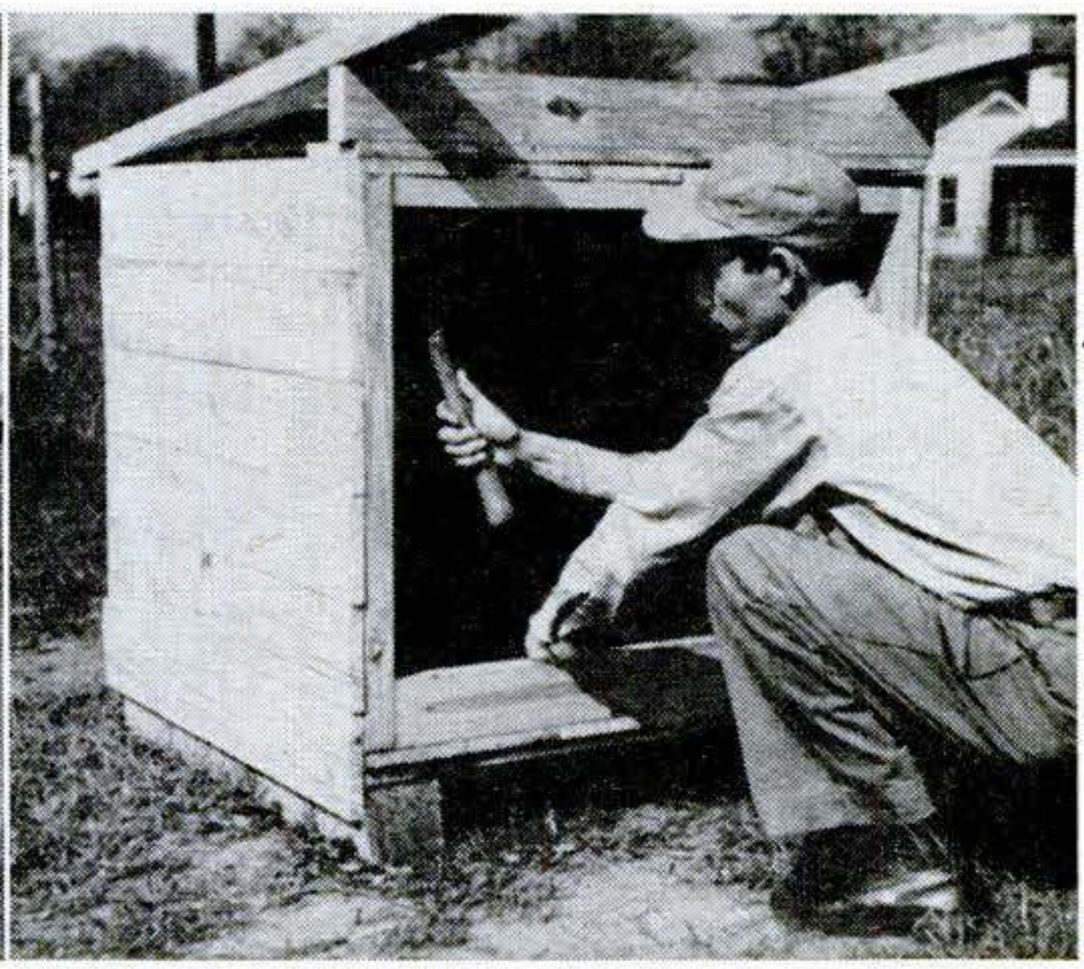
1. Double-thick floors with a sheet of tarpaper between help provide a dry, draftless interior.



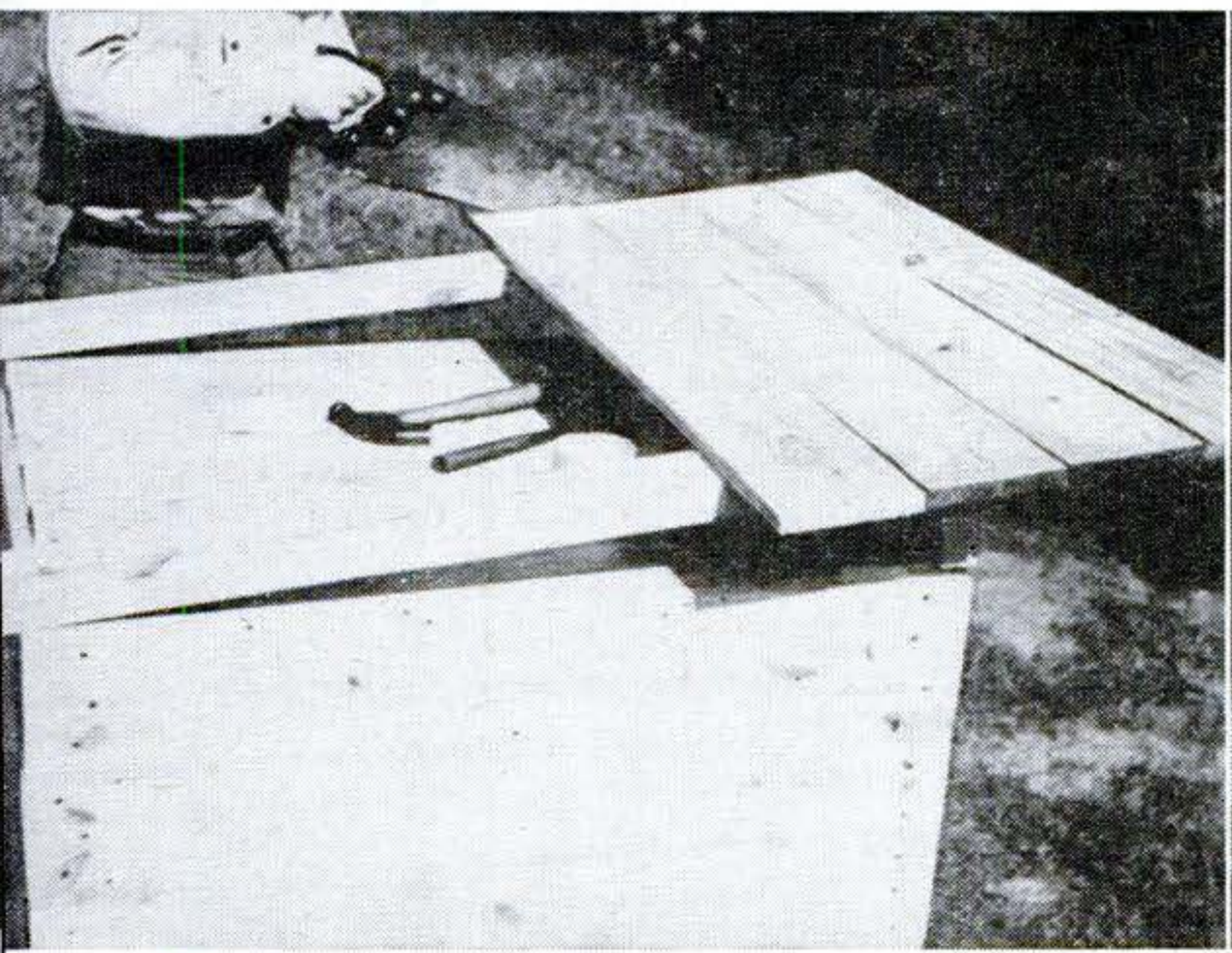
2. Brace each lower corner for extra rigidity. Added strength is needed when house is moved.



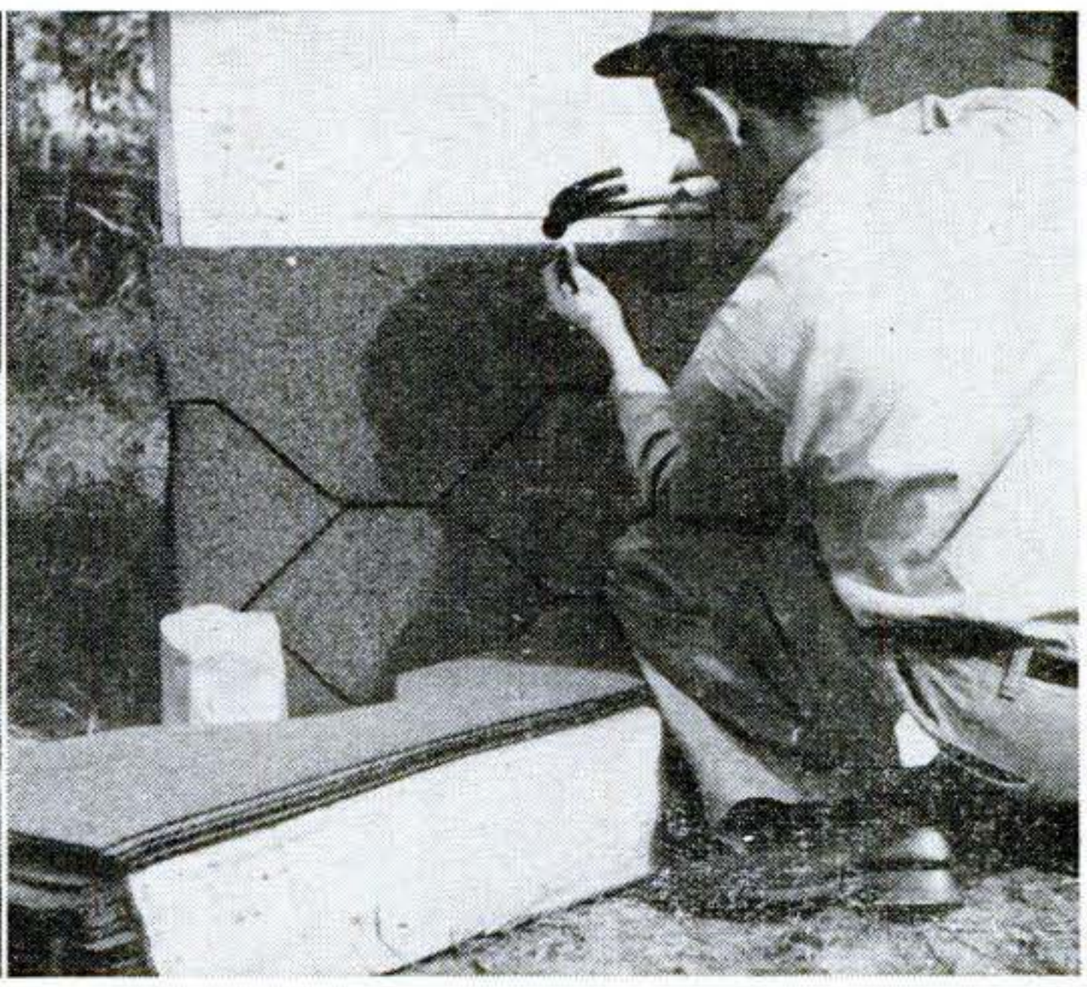
3. Ceiling boards should fit tightly. Space between roof and ceiling helps keep house cooler.



4. Dogs quickly learn to stay away from places where they get hurt, so inspect inside for nails.



5. Extend roof 1′ in front and 6″ on each side and rear. Slope enough to drain water quickly.



6. Cover both the roof and sides with inexpensive shingles to keep out drafts and dampness.

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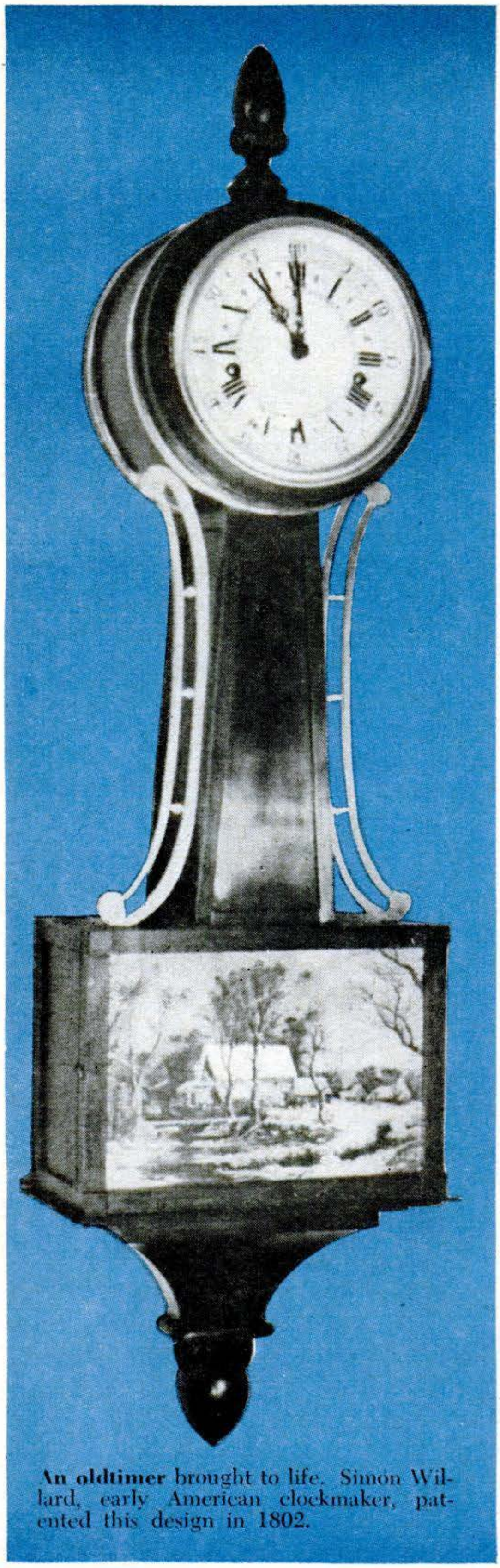

An oldtimer brought to life. Simon Willard, early American clockmaker, patented this design in 1802.

Banjo Clock Made of Walnut and Brass

By A. L. Elliott

PATTERNED after a type of timekeeper that gained great popularity in the early years of the last century, this banjo clock makes a handsome addition to a room furnished in Early American.

Its case, made of walnut, is decorated with brass. The barrel that holds the works was turned on a lathe. Dovetail joints are used in the throat and lower box.

The first thing to do is to obtain the works, since the size of the barrel will depend on that. If a good works from a mantel clock is available, you have the advantage of a rim and crystal—and perhaps a face—ready for use. The design shown here is for a fairly large works. If the one you use is smaller, alter the dimensions to suit.

Follow the nine steps in the drawing on page 200 to turn the barrel. First glue up scraps to form the main part of the barrel. Use a solid piece, however, for the front since it will not be covered by veneer. After fastening the faceplate to the softwood plug, turn a recess in the solid piece to suit the works plate or face of the clock. Then turn the outside of the barrel. Take the work off the faceplate, turn it around, and remount

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with the faceplate in the recessed end. Cut out the plug and inside of the barrel, turning all the way through the solid piece. Lastly, apply glue all around the barrel and fit the 1/28″ walnut veneer. Use sheet rubber or cork between the veneer and clamps.

If you use a clock with a pendulum, check to see how much room is needed for its swing before you begin to build the throat. Then cut the four sides from ⅜″ stock, using the prettiest piece for the front. Dovetail the edges at 1″ intervals. Go ahead and glue up the throat.

The lower box is made next. Sides are ⅜″ stock and the base is a ¾″ piece. Note the two rounded steps under the base piece. Rabbet them out, sand them round, and cut the upper part to fit up inside the ends and sides of the lower box. Small strips are glued inside the box ¼″ from the back. The back panel of ¼″ walnut plywood is fitted inside the box and screwed to these strips.

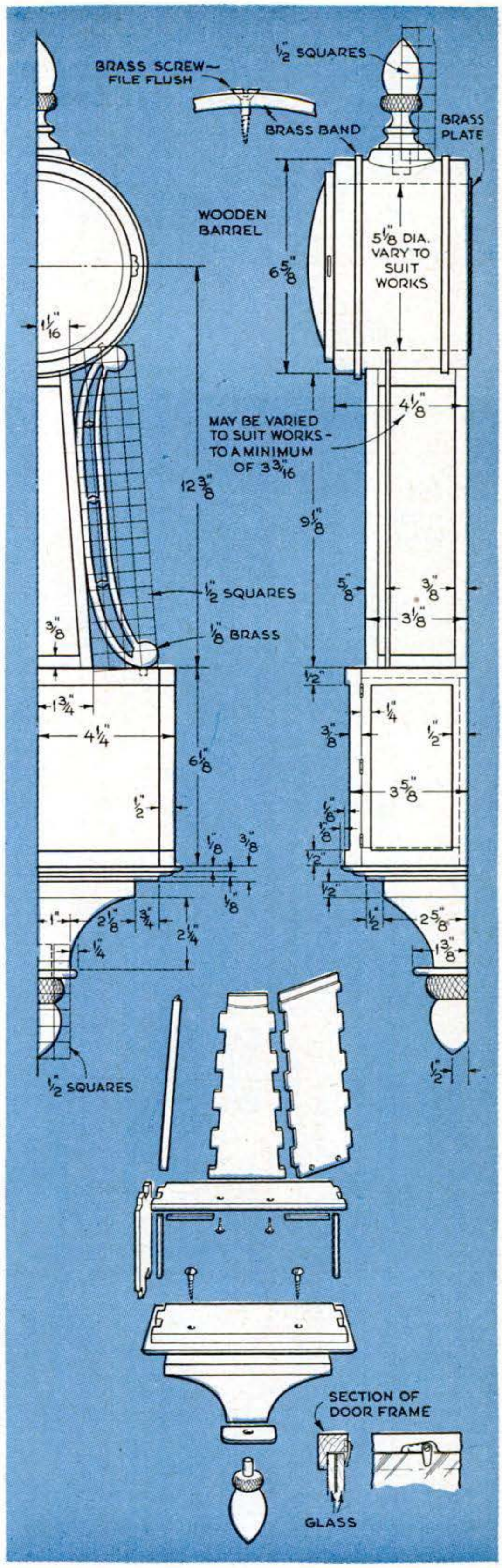
Next saw out and finish the lower bracket and screw it to the bottom of the box. Throat and box then can be screwed and glued together. Don't fit the barrel to the throat until you're ready to install the side rails. These brass rails are the show pieces of the clock, so do them carefully. Cut them from ⅛″ brass—don't forget the studs that fit in the barrel and box—and smooth them down with a file and emery paper. After final polishing, give them a coat of clear lacquer.

Cut a hole in the barrel to fit the rabbets on the throat. Next bend the two ⅛″ brass bands that circle the barrel. Drill about five holes in them and fasten them to the barrel with flathead brass screws and file the heads flush. Fasten the throat and barrel together with glue and screws, fitting in the brass side rails at the same time. The 1/16″ by ⅜″ by ⅜″ walnut corner angles for the front of the throat may be made with a rabbet plane and then glued in place.

Make the picture frame to fit the front of the box perfectly. Rabbet the pieces of frame to just take the two pieces of glass and the picture. By making the glass removable, the picture may be changed when desired. A Currier and Ives print goes well with this type of clock. Swing the door on three small brass butt hinges.

Turn the decorative acorns for the top and bottom carefully, carving the caps in about ⅛″ squares.

If you have to make a face for your clock, cut it from 18-gauge half-hard sheet brass. Drill the center hole and the holes for the



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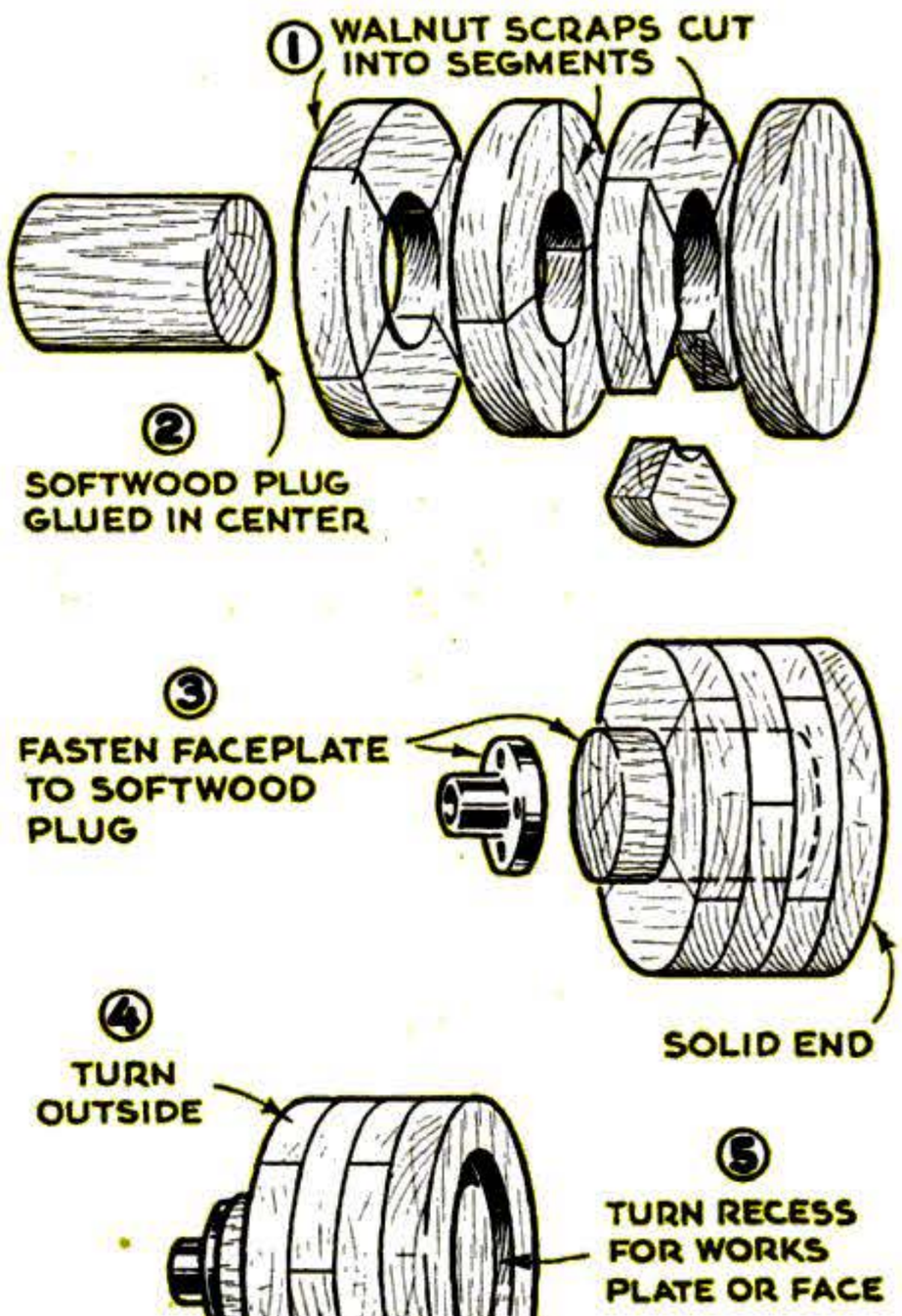

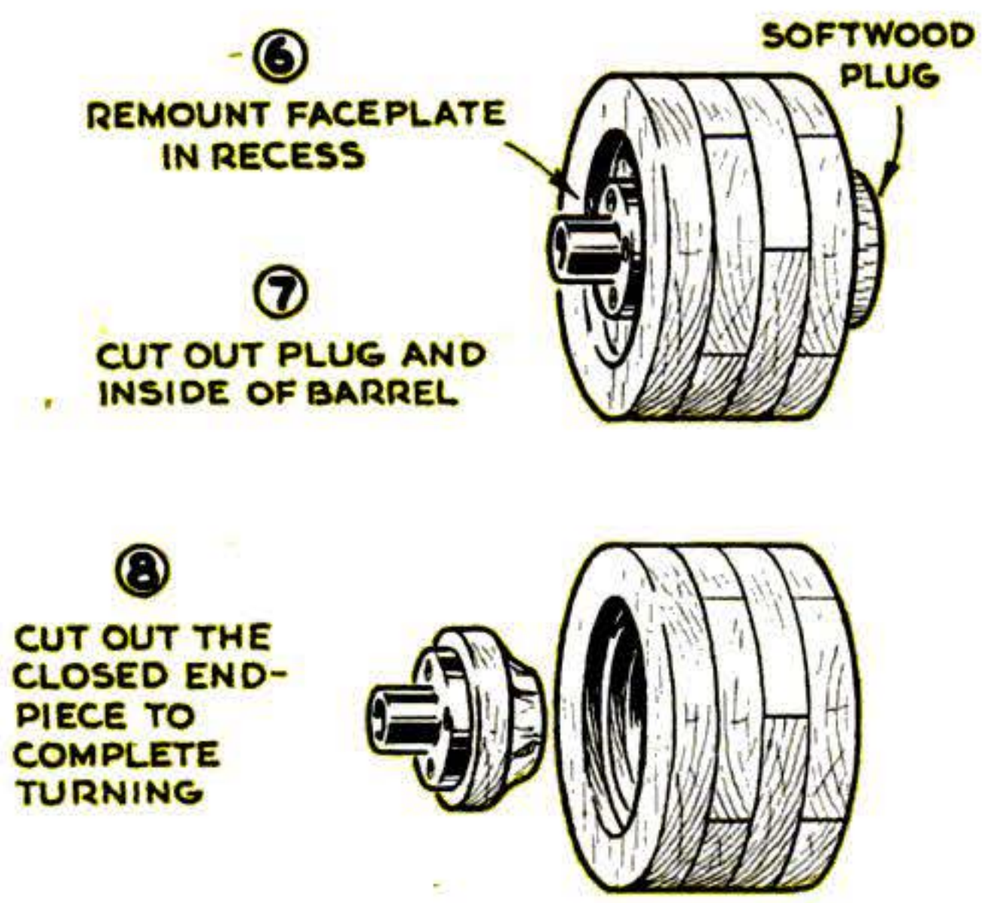

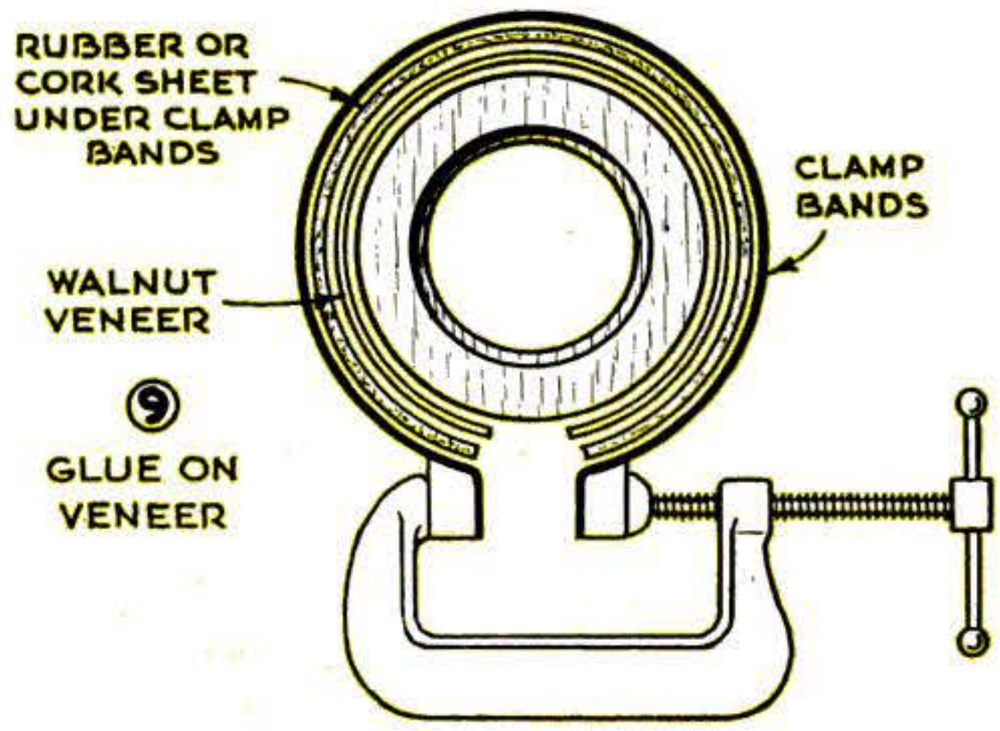

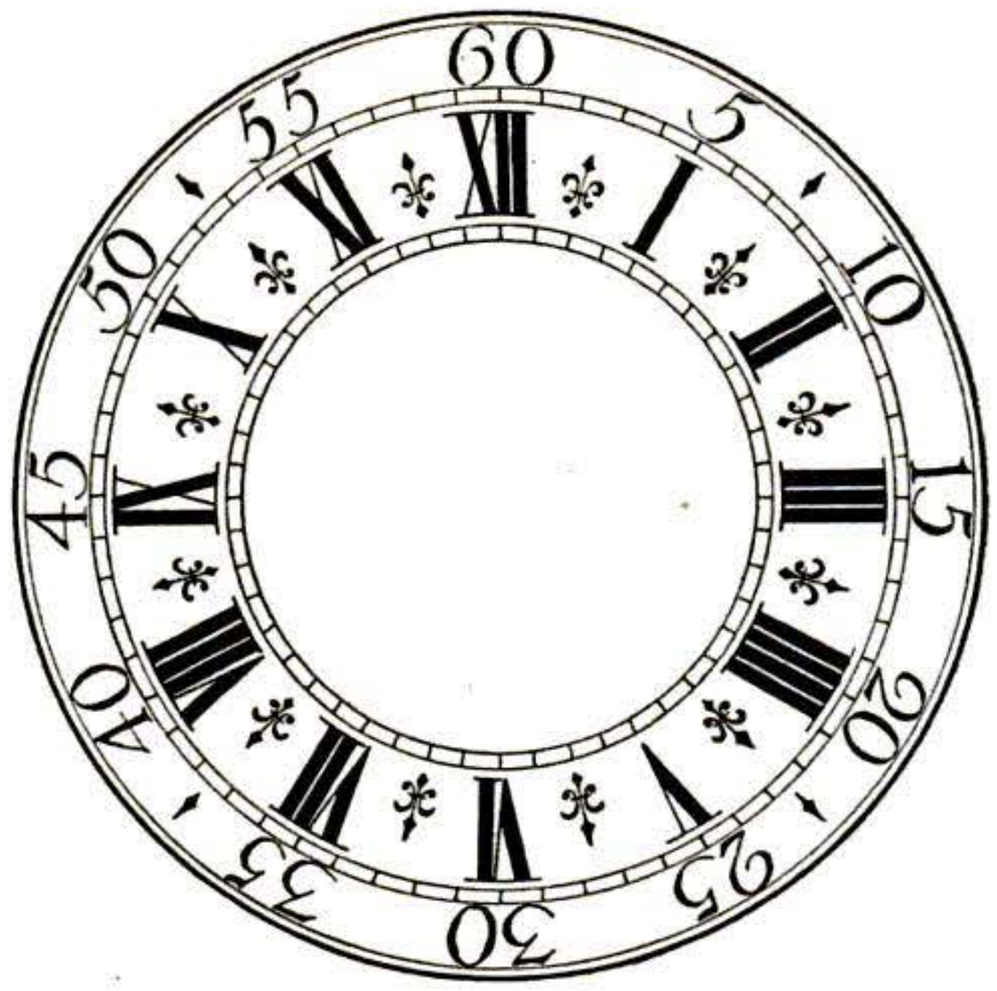

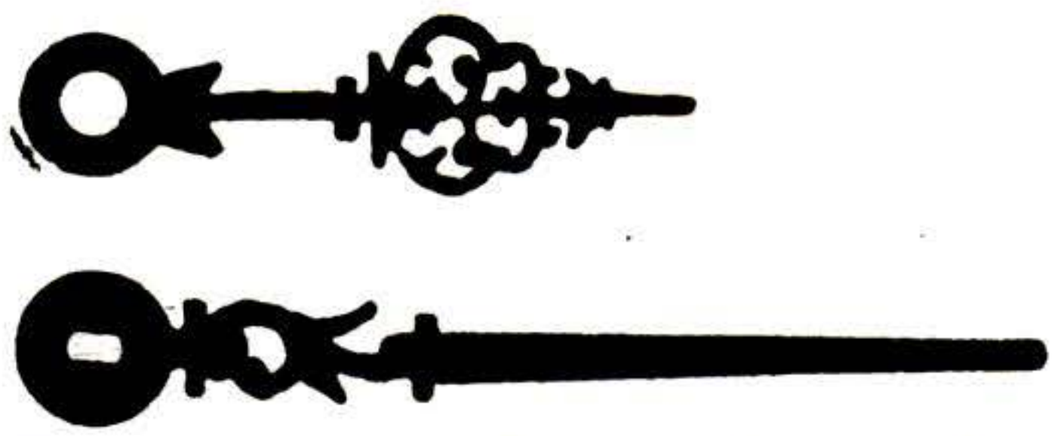

For the average works of this type of clock, the hands outlined above are about the right size. Photograph or photostat the face and blow it up to fit the size works you use.

winding and adjusting keys and smooth all edges with emery cloth.

There are a couple of ways you can put the numerals and decorations on the face. The simplest one is to photostat or photograph the picture of the face given here. Blow it up to the right size and glue it to the brass plate. Then cover it with a couple of coats of clear lacquer. Or you can enamel the plate white and with a photo negative of the face in an enlarger, focus on the enameled plate. Then draw the numerals on the plate with India ink. Brush on clear lacquer when the ink is thoroughly dry. The hands shown in the drawing can be traced and cut from the same brass as the face. After sawing them out, finish them with small files and emery paper and apply black japan or enamel.

The finish you give the walnut is important. Sandpaper the entire case to a glass-like smoothness and apply walnut stain and walnut filler. Follow with three coats of hard varnish, rubbing between coats with wet No. 400 or finer abrasive paper. Rub the final coat of varnish with No. 600 wet paper followed by pumice stone and paraffin oil for a rather dull finish. END

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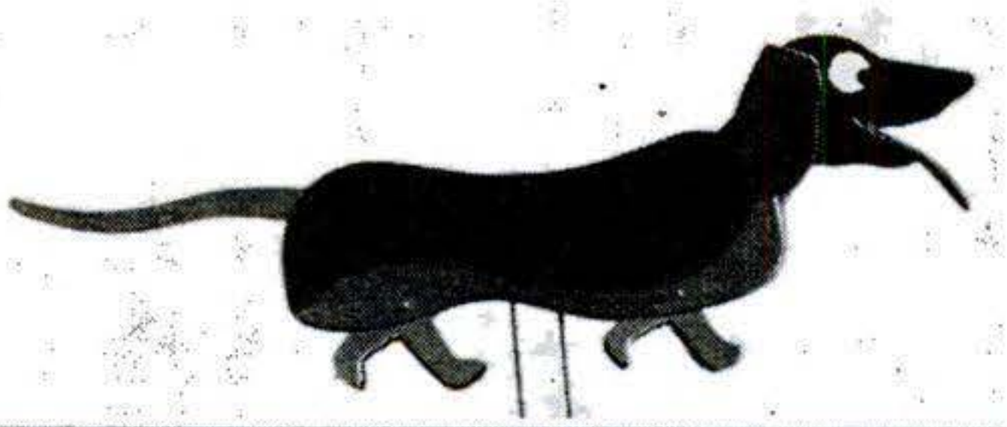
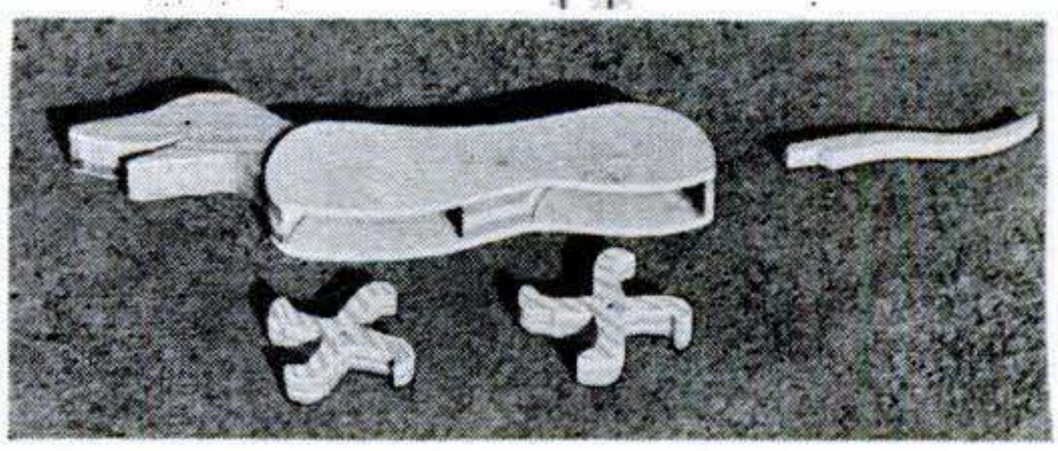
Toy Pooch Runs with Car

AT WHATEVER speed you drive, this toy dachshund will keep up with you, his short legs spinning and his long ears flapping. Mount him on a fender and he'll keep a child amused on a long drive.

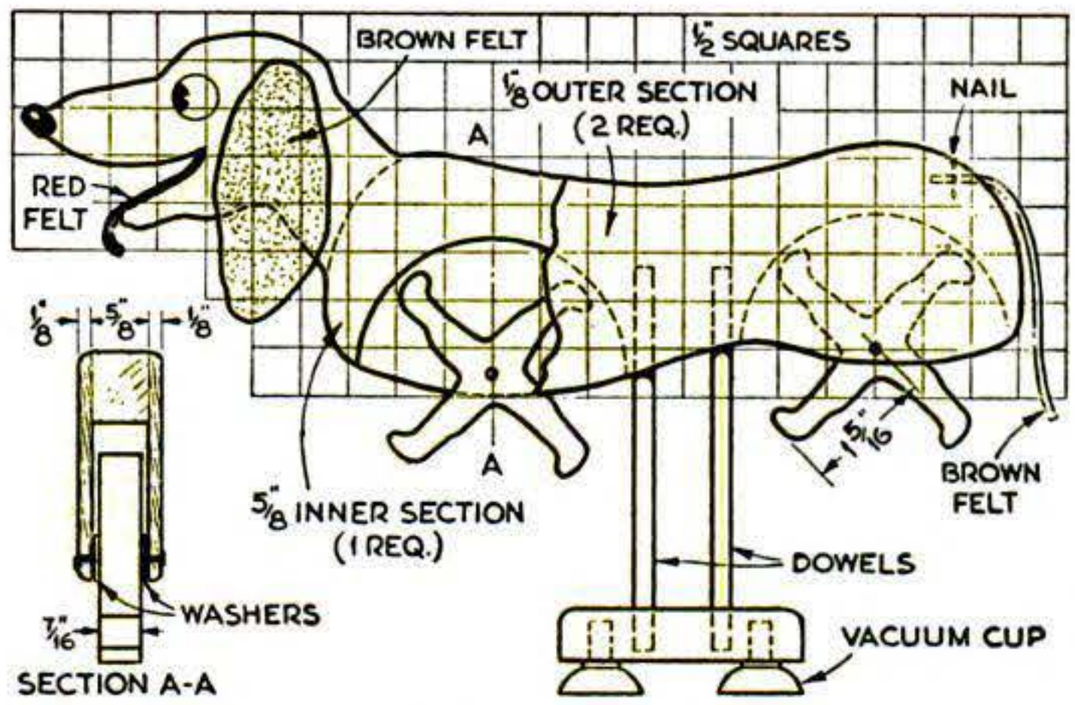
The four legs in each unit are scroll-sawed and mounted on a wire nail. Only two legs of each unit are visible at a time, but they'll spin in the slightest breeze. Drill the holes for the nails slightly large for free turning and place thin washers on each side.

Cut the inner part of the body and the head from one piece of ⅝" stock, with two half-round cutouts for the leg units. The two sidepieces of the body are ⅛" plywood. Glue them on before putting on the ears, red felt tongue, and eyes. Tack on the brown felt ears from the underside. When they hang down, the tacks will be concealed. The tail also is brown felt and is nailed into a saw kerf as shown in the drawing. You can cut the eyes from white gummed paper and ink in the darker parts. Paint the body chocolate brown, the belly and legs tan, and the feet brown. Then drill holes in body and base for the dowels.—*Hi Sibley, Nuevo, Calif.*

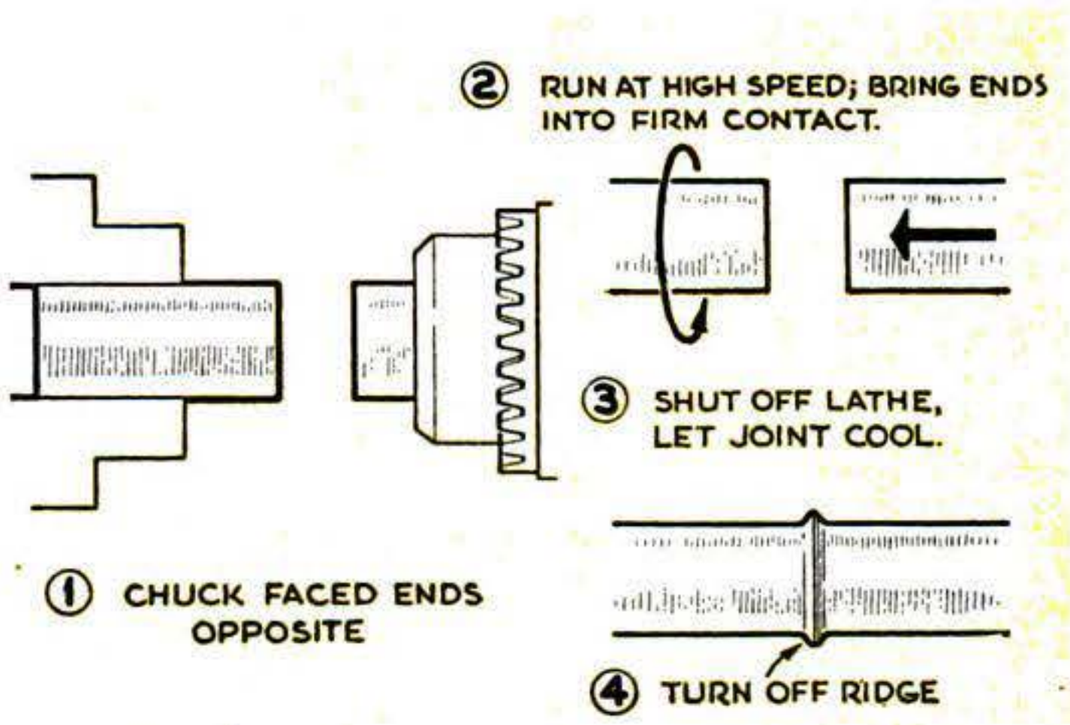




Completed toy is seen in top photo. Wooden tail pictured was discarded for one made of felt.

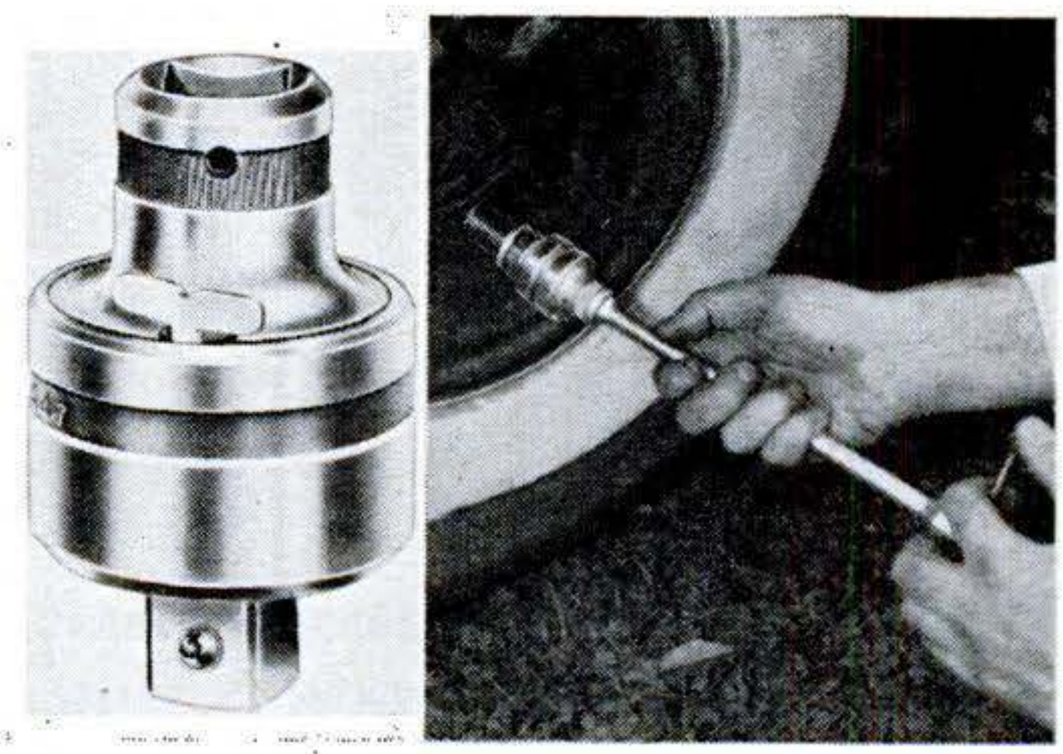


Head and inner part of body were cut from one piece of ⅝" stock. Sides are ⅛" plywood.



Big One Made from Little Ones

Two short pieces of plastic rod can be fused into one length by following the steps outlined above. First face off the ends of the short pieces. Chuck one in the tailstock and the other in the headstock with the faced ends opposite. Run the lathe at high speed and bring the ends of the rods together firmly. This fuses the two pieces. Shut off the power and let the joint cool. Then turn off the ridge.—*C. P. Desire, Bronx, N. Y.*



Ratchet Fits Socket Wrenches

THE handy principle of ratchet screwdrivers, braces, and other tools is duplicated in this compact tool that changes any ½" socket wrench into a ratchet wrench. Made by Willard G. Gregory and Company, of Los Angeles, the tool has male and female ends. The ratcheting direction is reversible. Useful in the home and shop, the ratchet adapter also makes it easier to unscrew the lugs when changing a tire.

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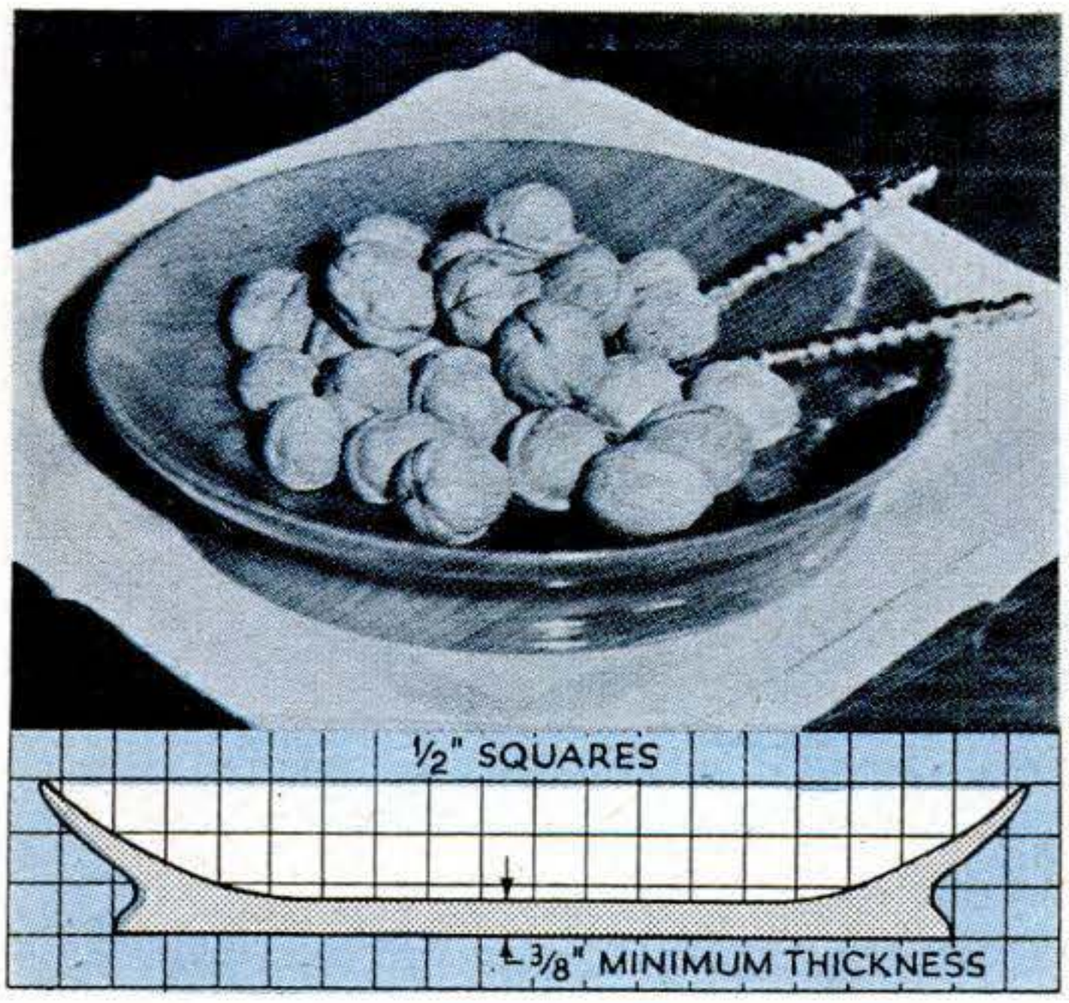
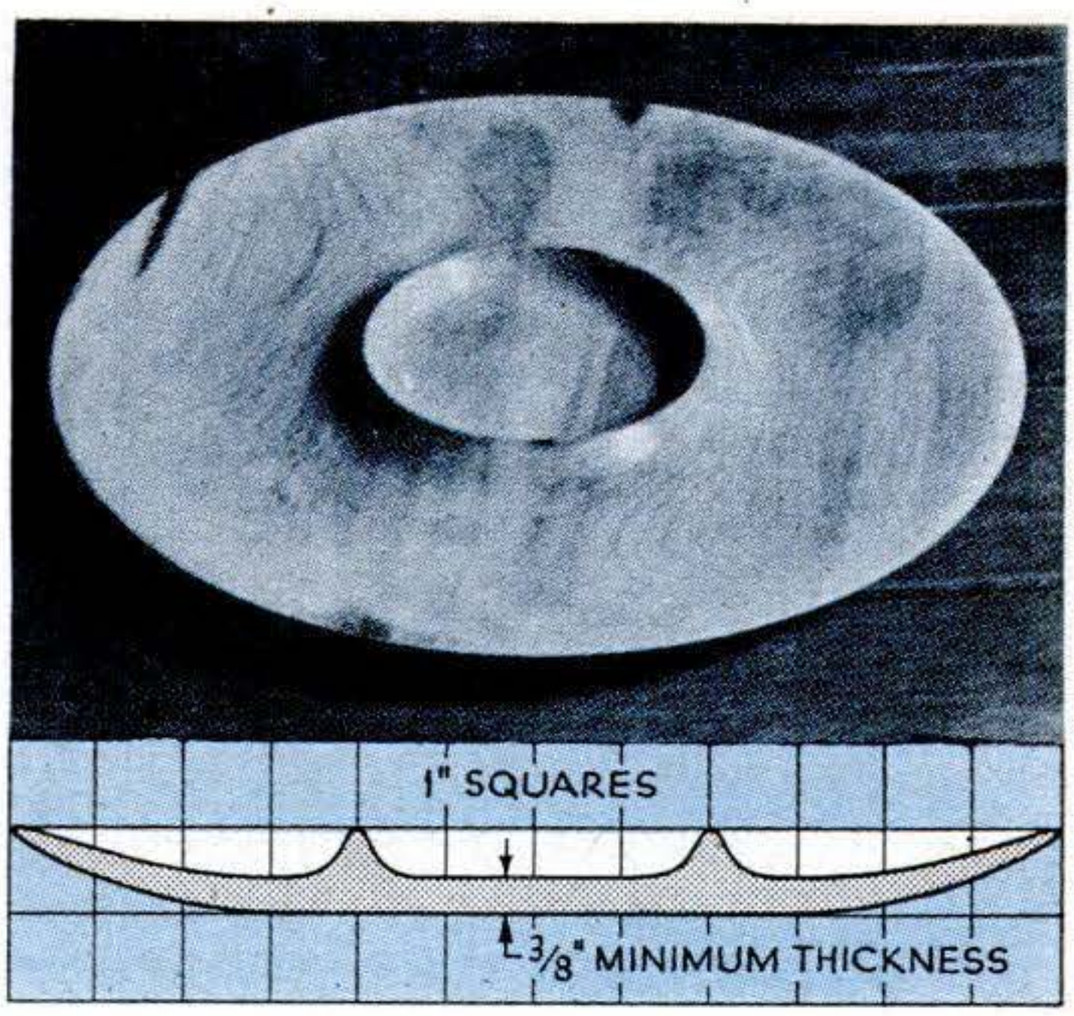




Turned from solid hardwood blocks, this tray and bowl are attractive additions to a buffet or table. Both, of course, are lathe jobs. Use well-seasoned stock. If this is unavailable, rough-turn the projects and then lay them aside a few weeks for additional seasoning.

Turned Bowls Hold Nuts and Snacks

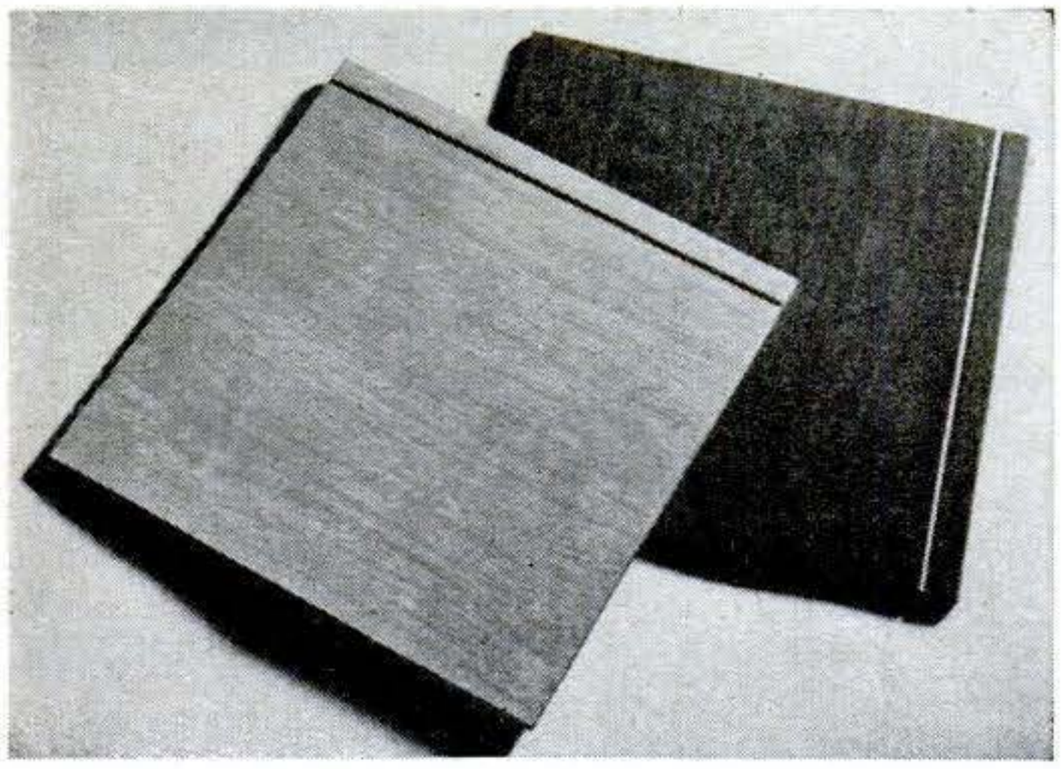
THESE two projects—a nut bowl and a sandwich tray—provide an interesting evening or two at the lathe and also make pleasing additions to your wife's serving platters. Lewis Johnson, of Bremerton, Wash., turned each one from a solid block of well-seasoned hardwood.

Mount what will be the top of the tray or bowl on the lathe faceplate and turn the bottom first. Make sure the screws do not penetrate beyond the waste material that will be removed in turning the inside. After turning the bottom, sand it smooth while it is still on the faceplate.

To turn the inside of these pieces, glue the bottom to a wooden disk with a layer of paper between. The faceplate screws can then go into the disk, leaving no holes in the work. Don't use waterproof glue, since you'll want to separate the turned pieces from the waste disk by soaking them off with a damp cloth. (Soaking directly in water will swell and warp the turning.)

If you prefer to save the time and trouble of gluing, you can screw the work directly to the faceplate and glue a piece of felt on the bottom of the finished project to hide the screw marks. After thorough sanding, the pieces may be varnished or finished with lacquer.—*Edward R. Lucas, Poulsbo, Wash.*

Wood-Grain Finish Lithographed on Wallboard



REALISTIC wood graining is put on a Presdwood ® base by a lithographing process that uses a graining ink, ground coats, and finishing materials. A coating of clear lacquer is included to protect the finish. Made by the Service Products Division, Woodall Industries, Inc., Chicago, Ser-Wall ® panels are available in a number of sizes from 16″ by 72″ to 4′ by 8′. Edges are beveled and borders scored so they can be butted together and nailed in the score lines over existing walls. Price is about 33 cents per square foot. The panels can be washed.

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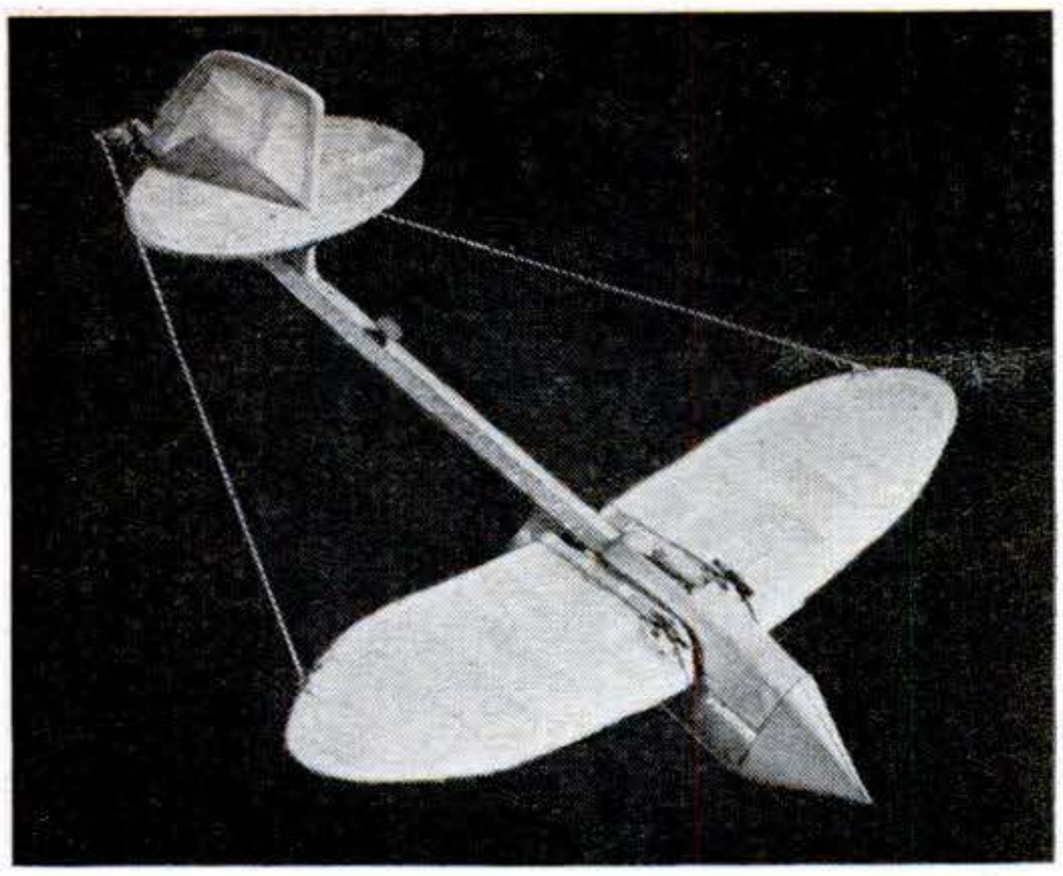


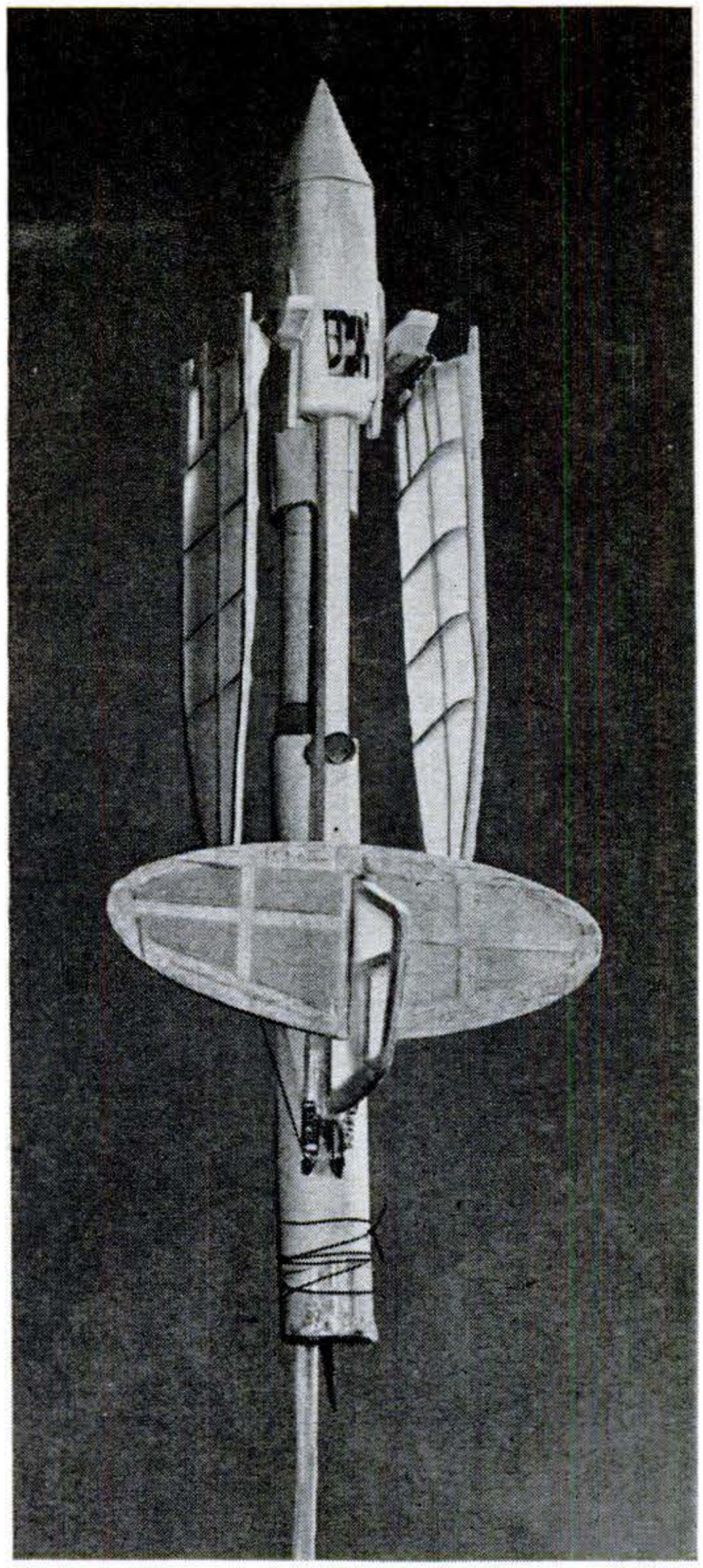
This is how the plane looks gliding down after the rocket tube drops off and the wings unfold.

Powder Rocket Unfolds Wings for Gliding

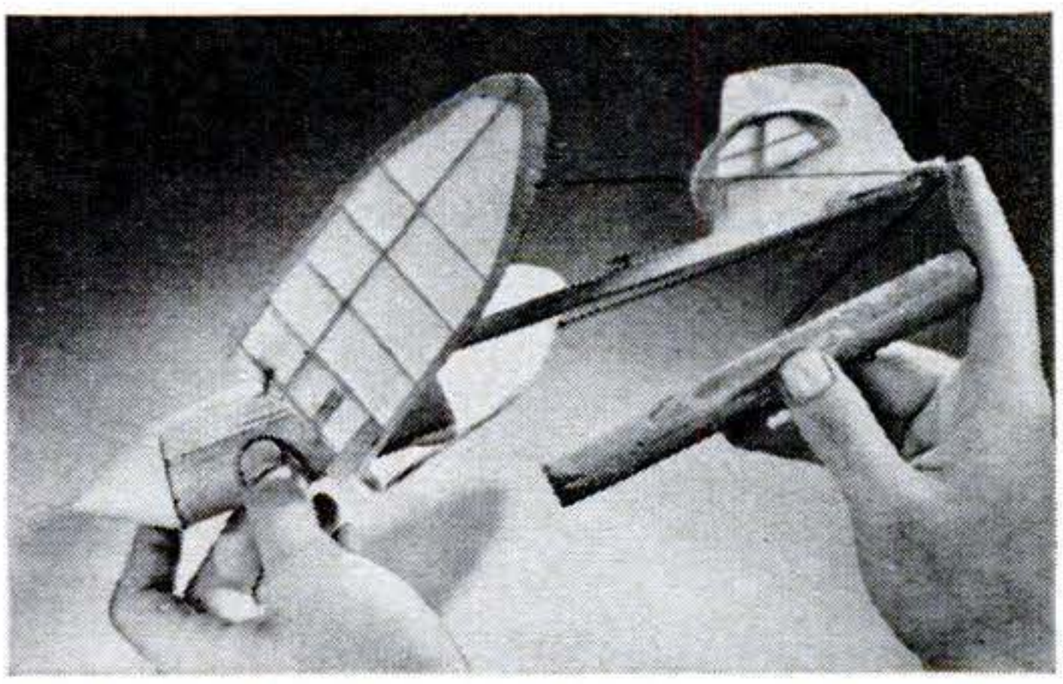
THIS rocket plane zooms 300′ up and then unfolds its wings to glide down.

Tom Vasilos, of Long Island City, N. Y., 19-year-old physical chemistry student at Brooklyn College, built the plane of pine and balsa. He also makes the rocket—a paper tube with about 1 oz. of black powder.

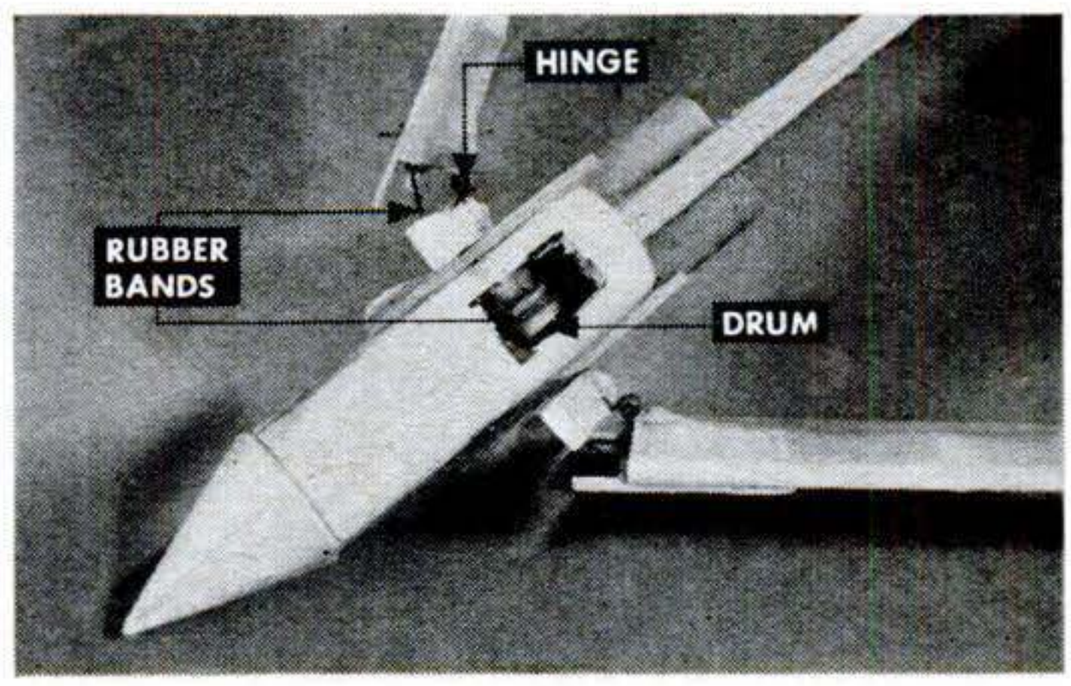
The ingenious wing arrangement—powered by rubber bands—uses both hinges and a pivot to put the wings in gliding position. A thread runs from each wing tip through screw-eyes at the tail. A hook on the rocket tube catches the thread and pulls the wings back when the tube is pushed into position. As long as the rocket drives upward, the wings are held back. When fuel is exhausted, the tube drops off and the wings unfold and rotate 90 deg. to glide.



Ready for firing. Rocket, tube, and stick drop off when fuel is exhausted and the thrust stops.



Rocket tube, about to be inserted, is pulling the wings back alongside the slender fuselage.



Rubber bands pull wings forward. Another band in the nose rotates drum to level wings.

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Suitable for living room or study, the gleaming copper center contrasts with the wood base.

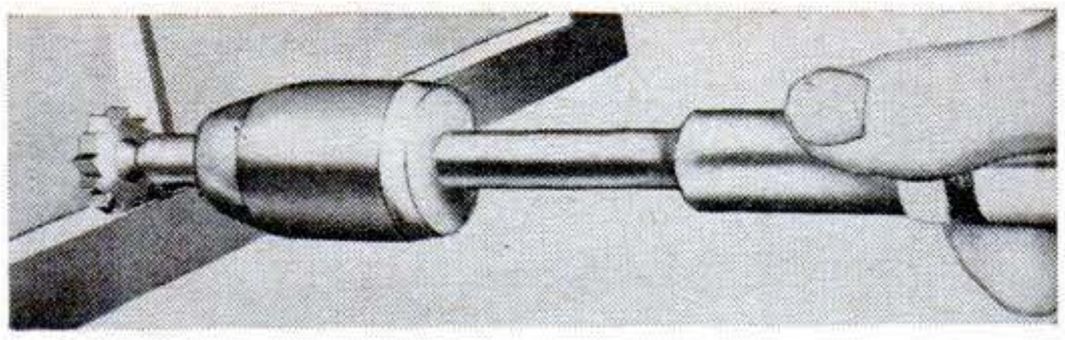
Hardwood Block Makes Ash Tray

I USED zebra wood for the man-sized ash tray shown here, but almost any hardwood will do—especially a burl. The center part that holds the ashes is rimmed by a copper ring laced across with piano wire.

First, mount the block on a faceplate and turn the recess as indicated in the sketch. Chamfer the top edges of the block. Then sand well and apply filler, two coats of boiled linseed oil, and five or six coats of paste wax—or use your own favorite finish.

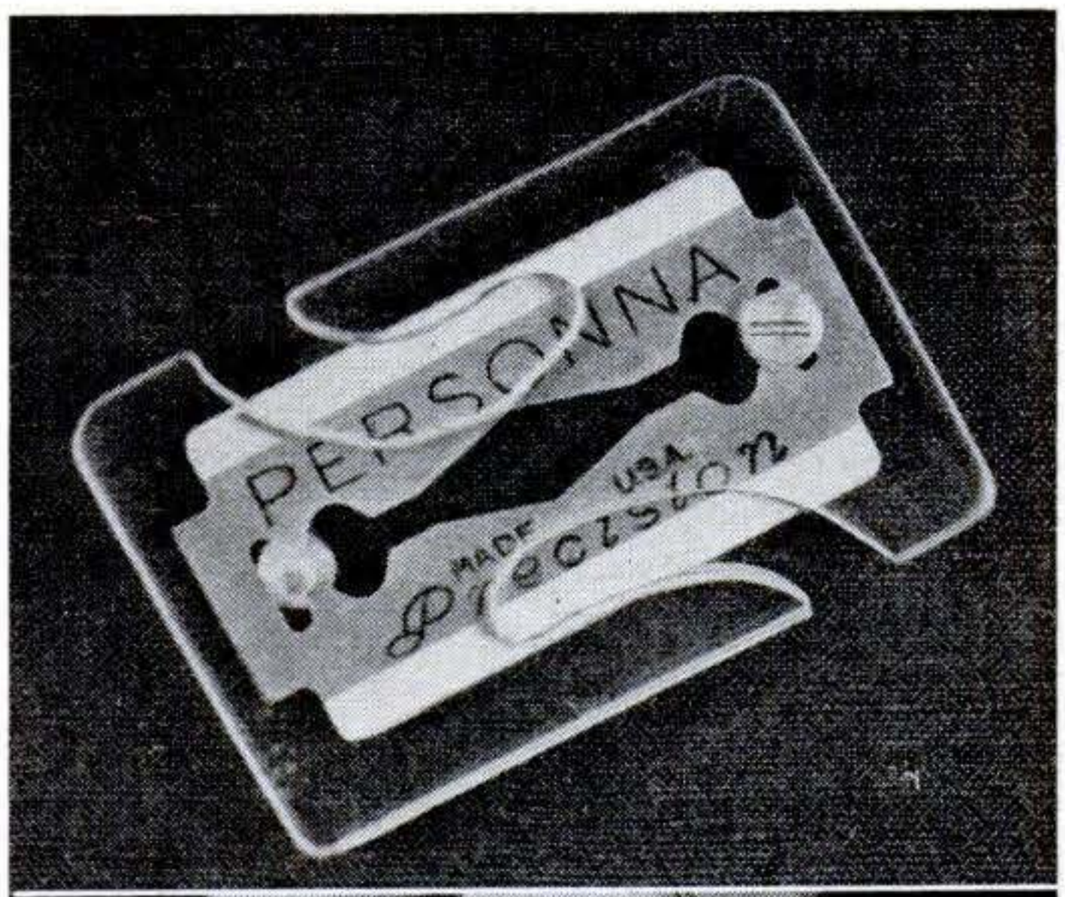
Turn a copper or brass ring to the dimensions shown. Divide it into six equal parts and drill. Silver-solder an end of a 48" length of piano wire alongside the No. 1 hole and thread the wire back and forth as shown in the drawing. Keep the wire taut and silver-solder the other end at the No. 6 hole. Then buff and lacquer the ring. I used white sand in the recess to catch the ashes, but a metal cup could be spun to fit under the ring.—*R. B. Carlson, Seattle, Wash.*

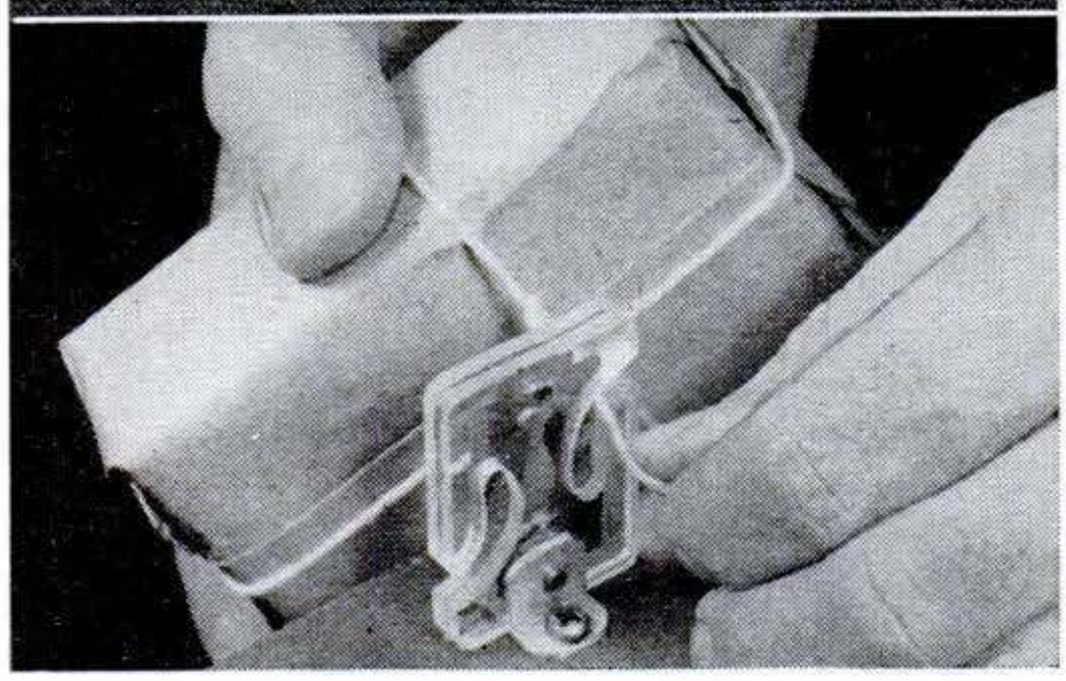
Keyway Cutter Removes Putty



WITH about 40 storm windows to refinish, I found the going tough when it came to removing the old, hard putty. I picked up a discarded industrial keyway cutter, sharpened it, and chucked it in a flexible-shaft tool to cut away the dried putty. It runs flush against the glass but, unlike a chisel, it doesn't start cracks. When sharpening an old cutter, give the teeth a slightly steeper rake.—*E. F. Lindsley, N. Prairie, Wis.*

Cord Cutter in Plastic Case





HERE'S a handy gadget for cutting cord that utilizes old razor blades. It's two pieces of 1/8" plastic with curving slots to expose some of the blade edges. The pieces are clamped to hold the blade with two small screws. Top photo shows it actual size. Bottom photo shows it attached to the edge of a bench by a small angle bracket. Since the plastic acts as a guard, it can be carried safely in the pocket.—*J.F. Gréce, Manhattan, N.Y.*

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Cactus Grows in Glass-Case Lamp

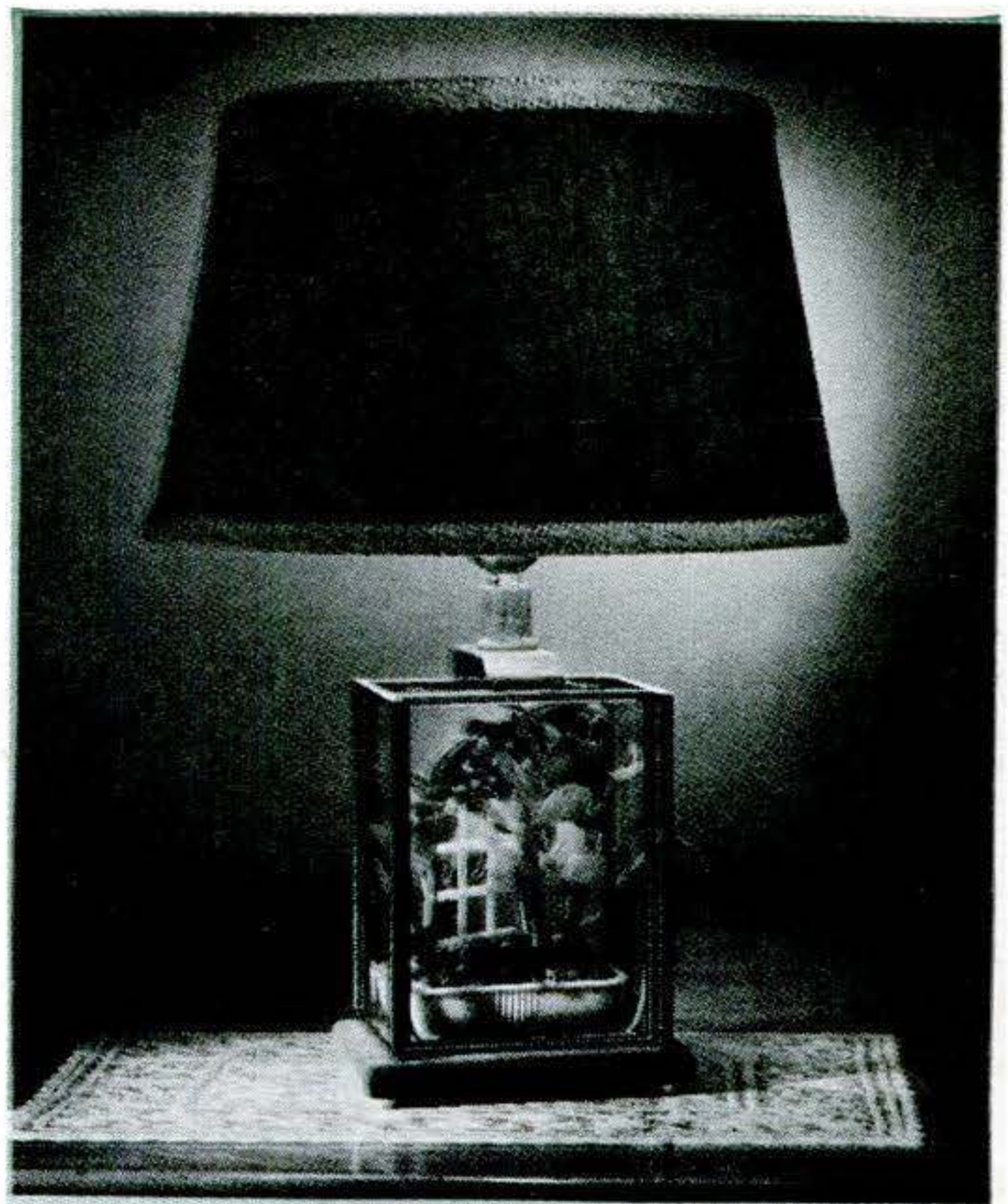
RATHER than have both a pot of plants and a lamp on one table, I combined them in this project. All parts were bought at a dime store, and making it is mainly an assembly job.

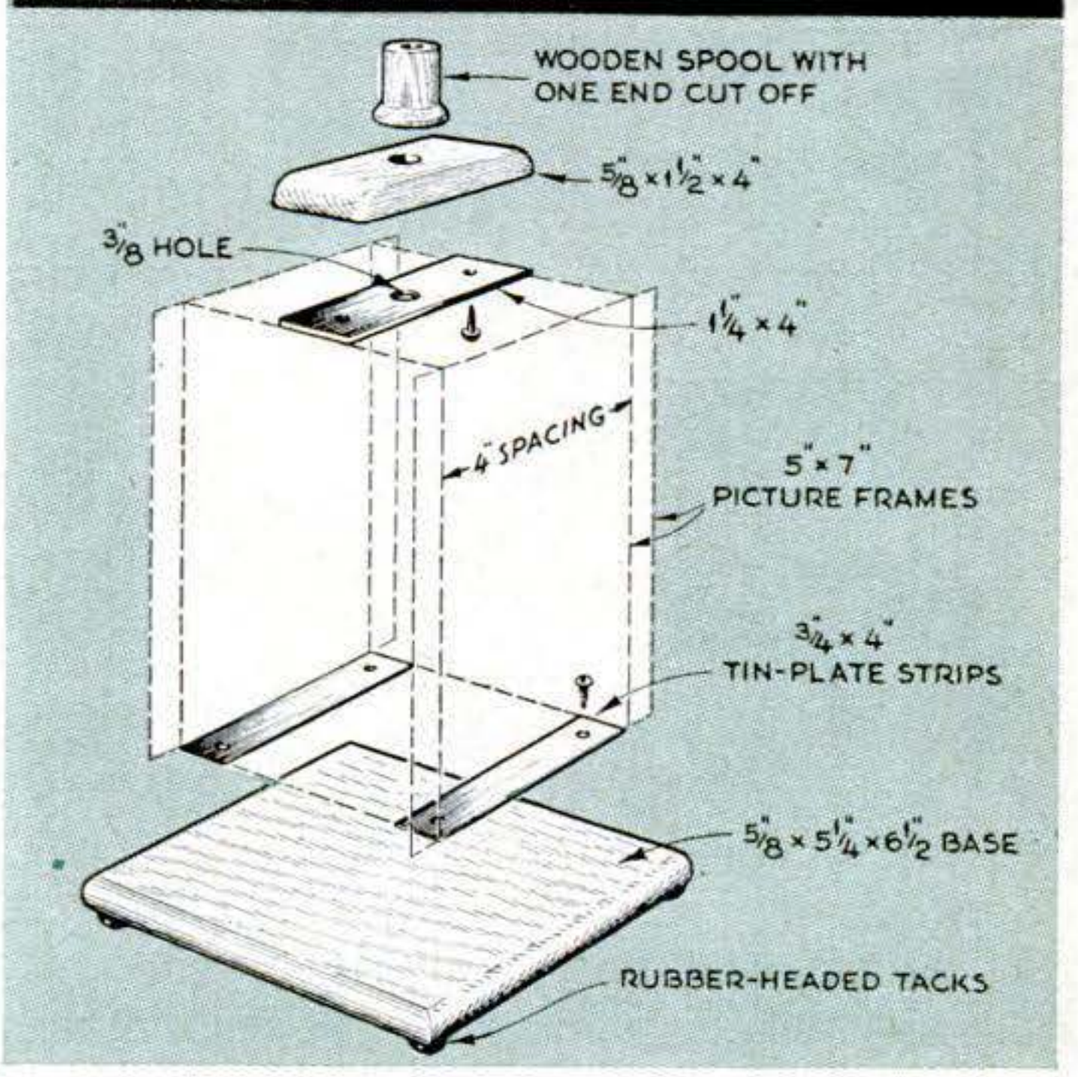
The glass walls are 5″ by 7″ nickel-plated picture frames with the cardboard backs removed. Only a little solder is needed to hold them together. The ¾″ by 4″ tin-plate strips, soldered to the bottoms of the frames, were cut from a tin can. Drill these strips for wood screws to hold the case to the base. The tops of two frames are joined by another strip of metal. Use triple-folded tin plate or a single thickness of heavier stock.

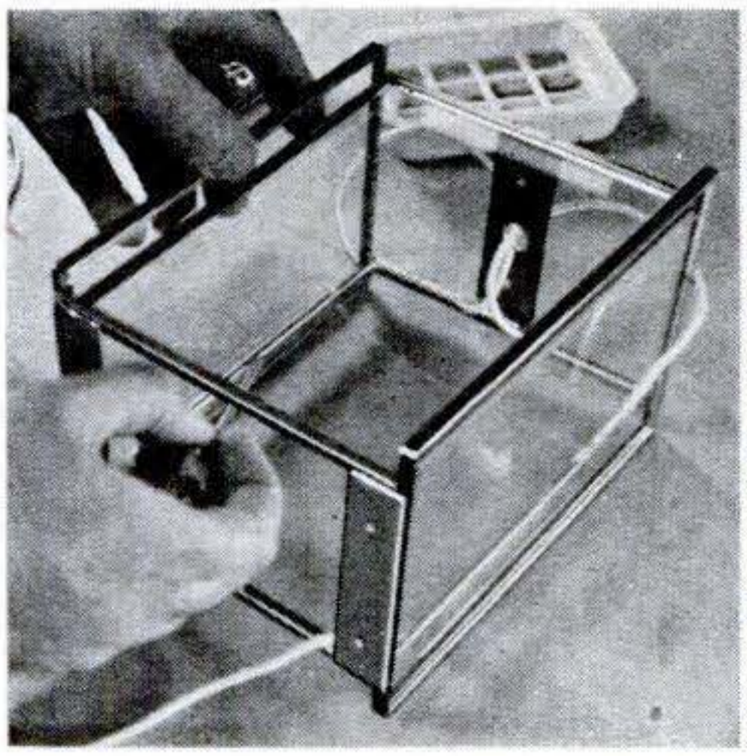
A small breadboard provided more than enough wood for the base and toppiece. The neck of the lamp is a spool with one flange sawed off. Drill two holes near corners of the base for wiring and enlarge the hole in the spool to take a ⅛″ pipe nipple 2¼″ long.

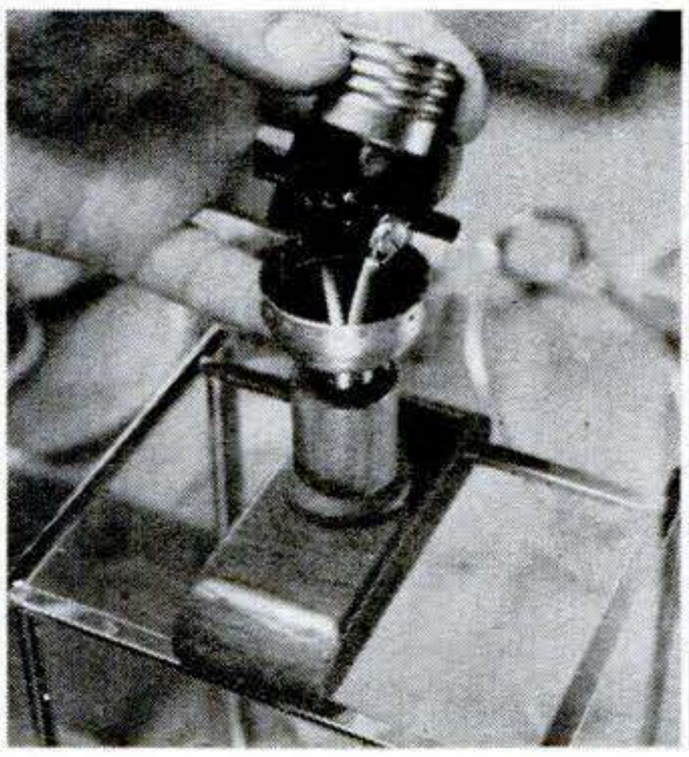
For a plant holder, I used a plastic soap dish. This dish had a small grille in it. I sawed the grille out and stuck it upright in the dish to act as a trellis.

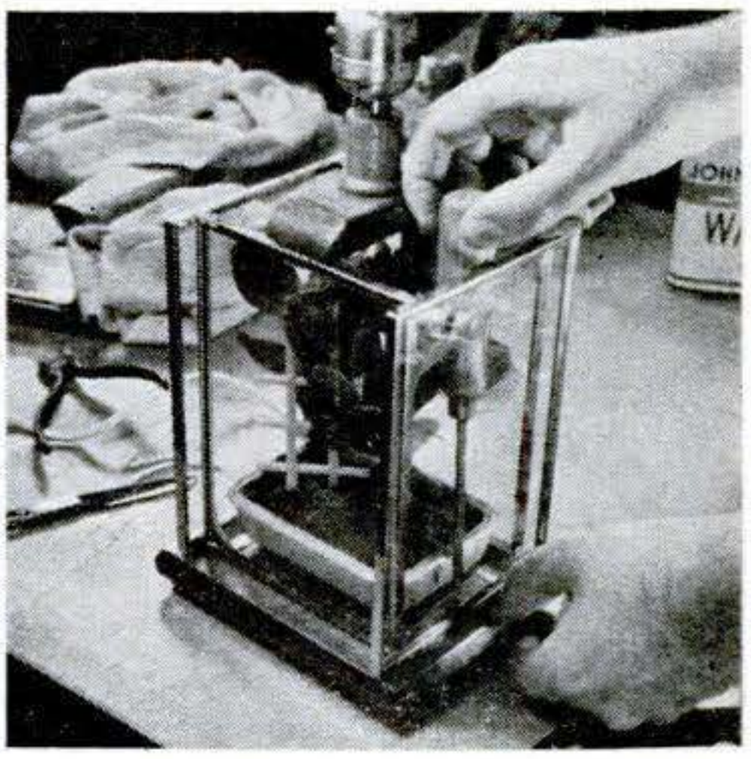
To wire the lamp, split enough cord to reach from under the base to the socket. Run the wires along corners of the glass case.—*Arthur Miller, Manhattan, N. Y.*











After splitting enough of the lamp cord to run from socket to base, press the wire into the channels in back of the picture frames as in the photo at left. The wired socket is slipped into place, center. Final step is screwing the ¾″ by 4″ metal strips to the base. In the drawing, note rubber-headed tacks as legs. These raise base for cord and protect table top.

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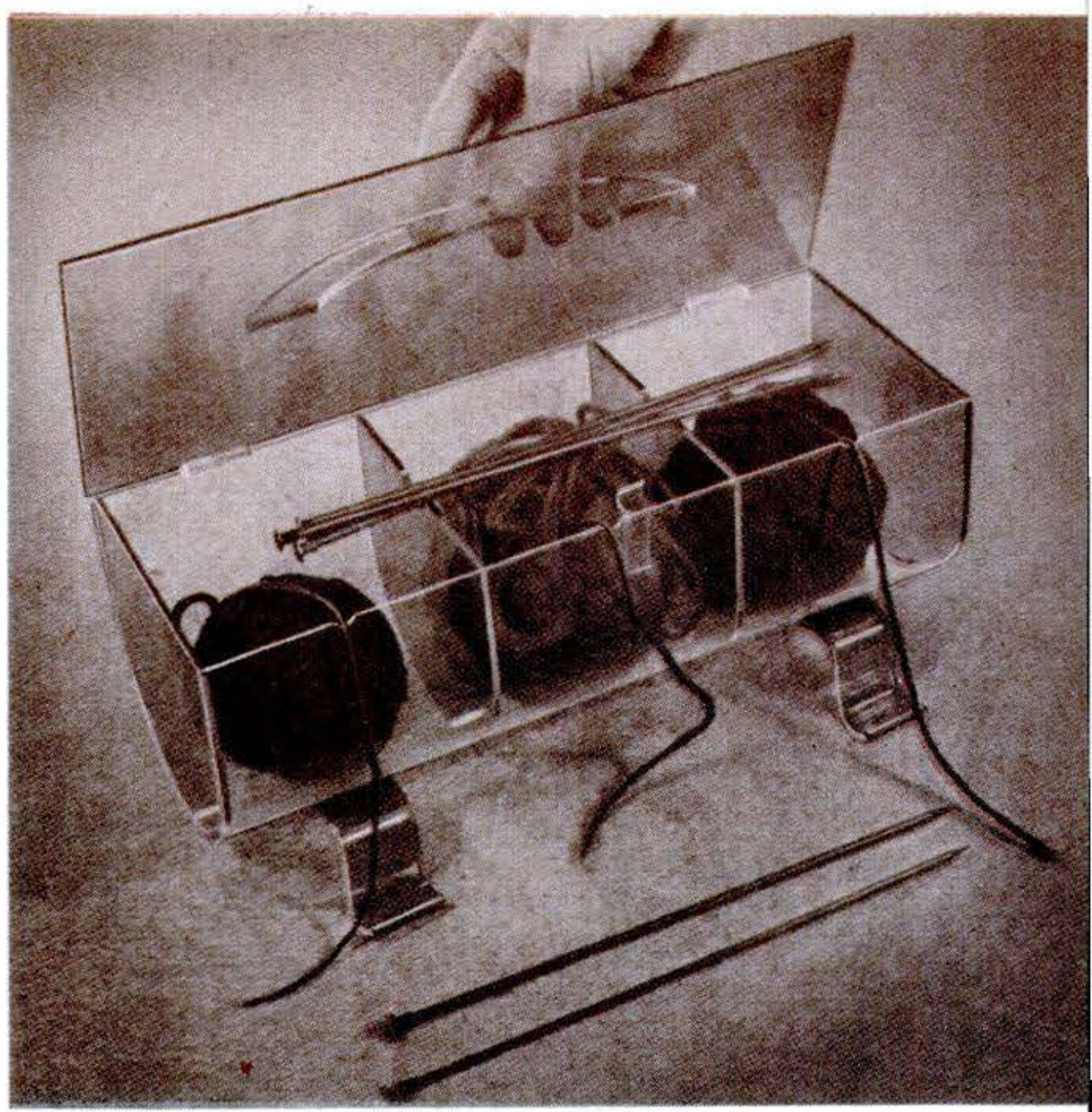
Plastic Knitting Kit Keeps Yarns Separate



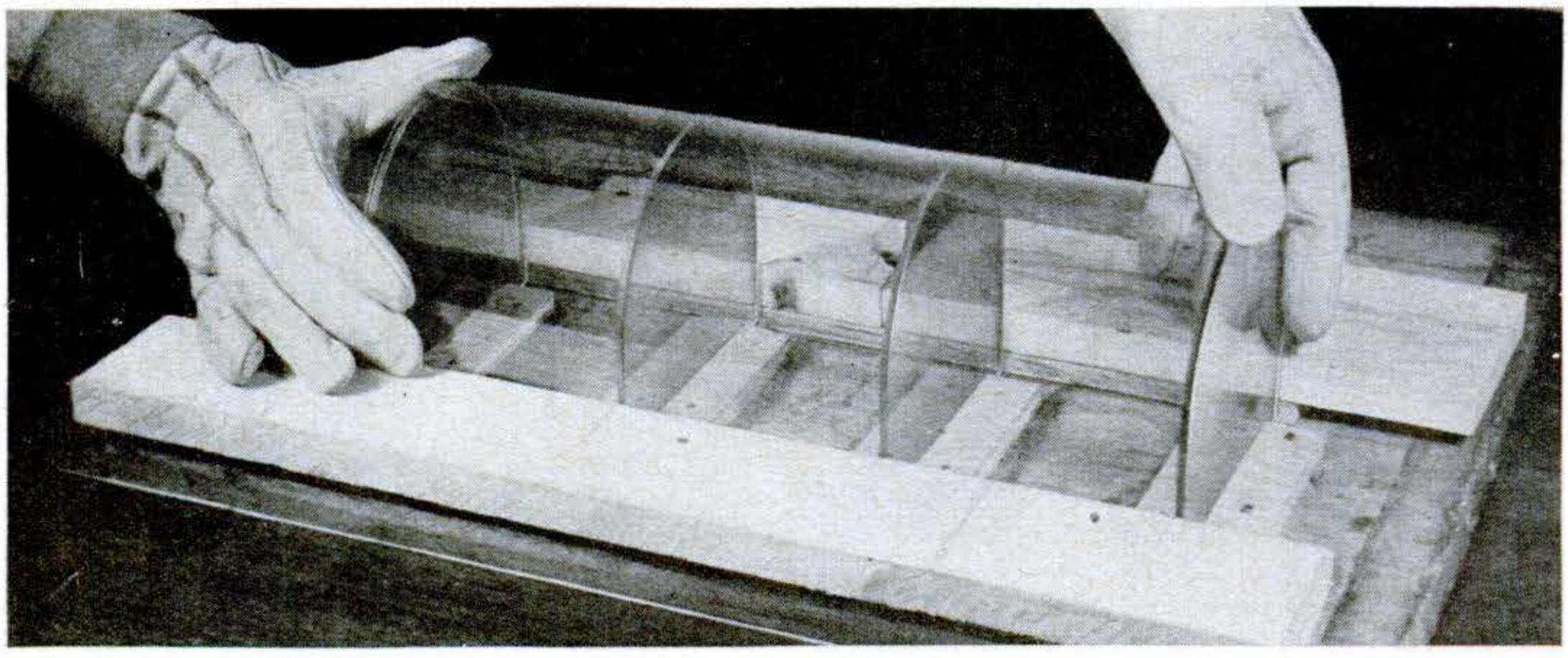
By Roland Cueva

UTILITY plus the gleam of polished plastic combine in this three-compartment knitting kit that also stores a half-dozen needles. A notch in the front wall of each compartment feeds the yarn out smoothly with the lid closed. The handle makes for easy carrying and a plastic catch holds the lid shut.

Use acrylic plastics—either clear, tinted, or a combination. I achieved a colorful effect in the kit I built by making the top, partitions, and legs of transparent amber and the other parts of clear plastic.

Following the plans on the opposite page, cut out the parts. Draw the outlines on the masking paper, leaving the paper on the plastic while sawing it. Use a fine-tooth saw for the major cuts and a coping saw for the needle notches in the partitions and yarn notches in the front.

Edge polish all the pieces before assembly. Smooth them with a medium-fine file. Then sand the edges with wet No. 7/0 garnet paper. Get the edges of the ends and partitions square so they'll make a good bond to the 1/16″ sheet that forms the outside. Continue sanding until all file marks are gone. As the last step, rub the edges



Form is made of strips of wood to hold ends and partitions while heated 1/16″ sheet is bent.

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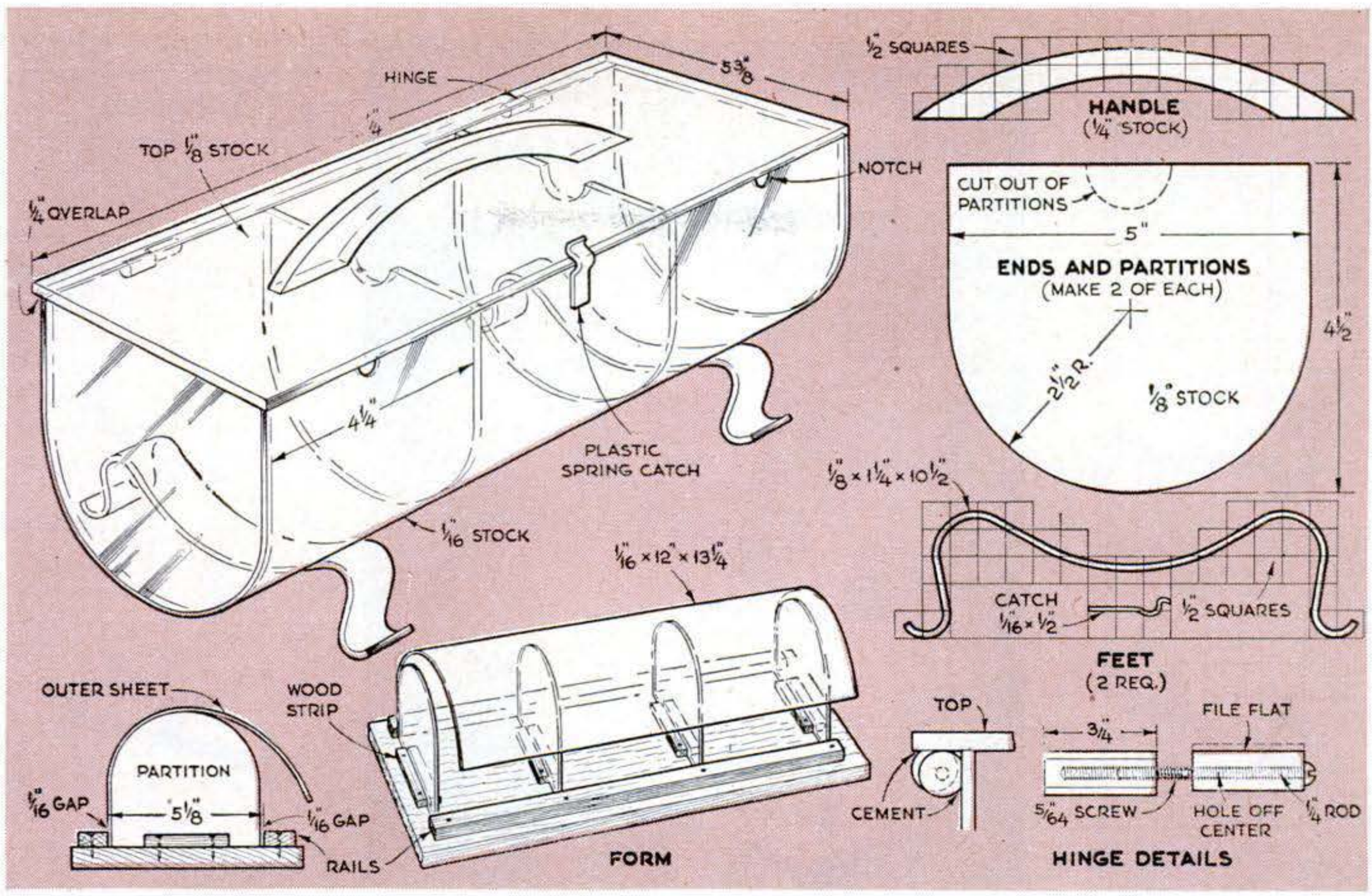


All the parts, detailed above, are held by plastic cement. No other fastening is required.

with powdered pumice and water until they shine. You can also buy a commercial compound for this step.

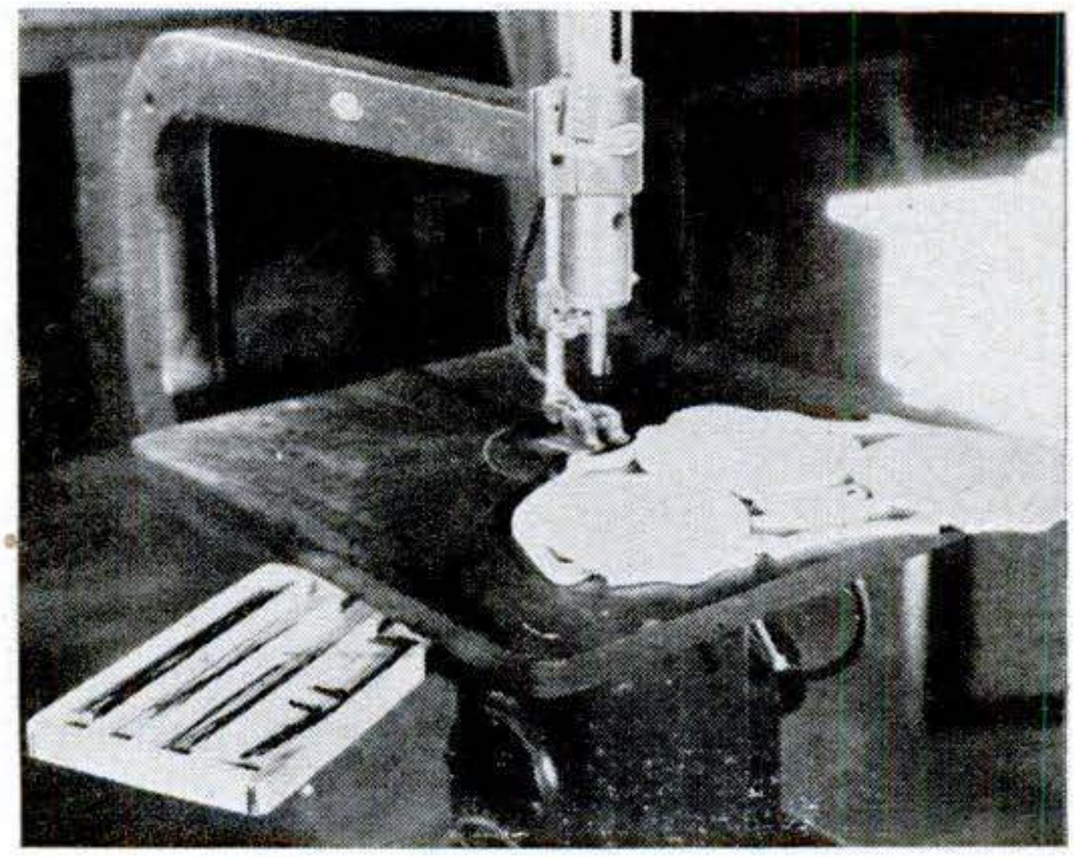
Mount the ends and partitions on the form as shown in the photo. Put the 1/16″ sheet in the oven on a piece of asbestos or on a cake tin and heat until pliable. This requires several minutes at about 250 degrees. Using gloves, remove the sheet from the oven and quickly lay it over the partitions and ends. Bend it evenly around them and down into the spaces along the rails. Hold the sheet firmly with both hands until the plastic has set in its new shape. The legs may be shaped by hand or over a simple form.

Hinges are made of ¼″ plastic rod, drilled for screws as shown. File them flat on one side and cement them to the overhang of the lid and to the back of the kit. The screws are inserted before cementing. Heat the catch and bend it with pliers. Cement it to the front with the lid closed for a good fit. Outward pressure on the catch releases it.

Assemble with plastic cement and clamp the parts until the cement has set.

Drawer for Jigsaw Blades Swings Out of Way

THERE is plenty of space under the table of a jigsaw for a drawer to hold blades and Allen wrenches. The one I made pivots on a flathead, countersunk machine bolt and has a knob on the other end for swinging the drawer out. Made of ⅜″ stock, the inside dimensions are ⅜″ by 4½″ by 9″. It has four sections and is assembled with glue and brads. In the pivot corner, there's a ⅜″ block with a hole drilled through it and the drawer bottom for the bolt. Locate the drawer so it will swing in and out under the table without interfering with the saw's operation.—*Dick Hutchinson, El Monte, Calif.*



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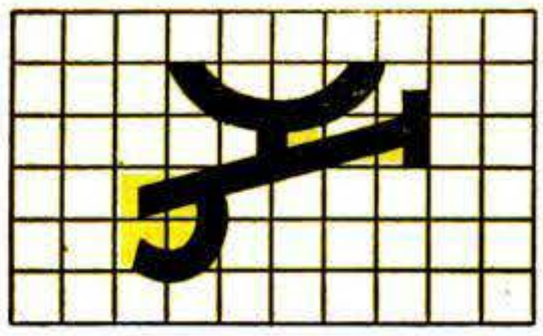
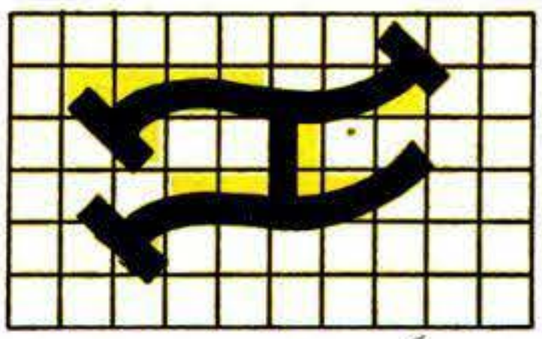
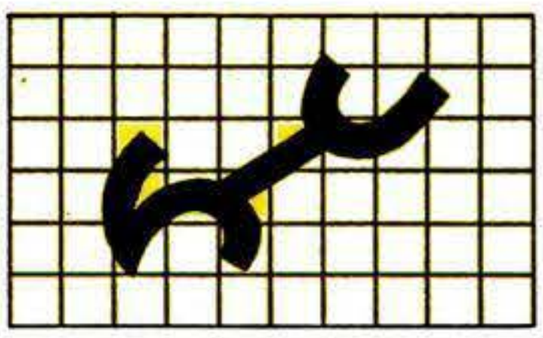


Rancho El Niguel, 1833
(Juan Avila)

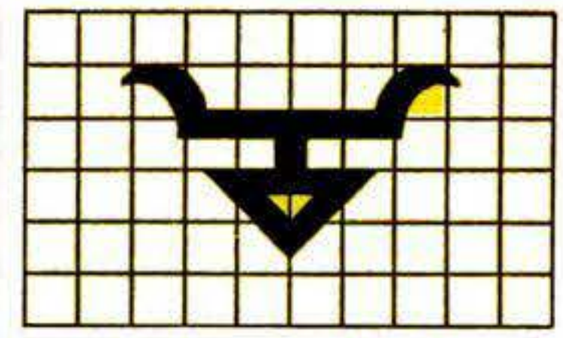


Rancho Santiago de Santa Ana, 1844
(Ramon Yorba)

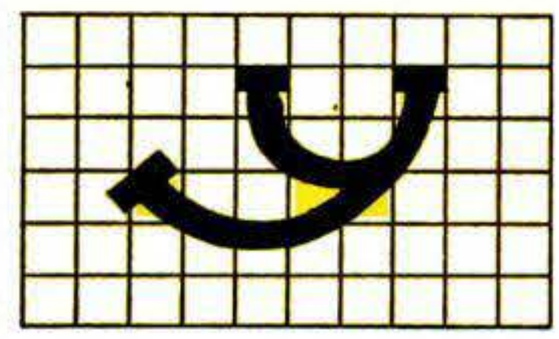


Rancho La Ballona, 1844
(Augustin Machado)

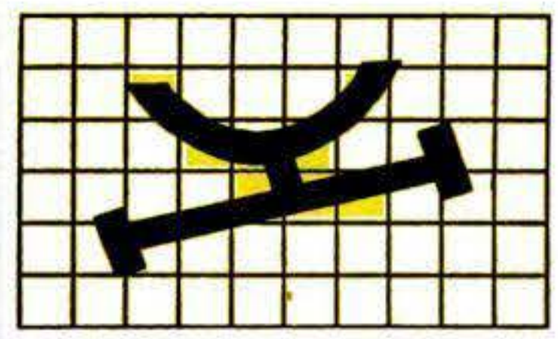
Western Style Barbecue Tray



Rancho Santiago de Santa Ana, 1844
(Bernardo Yorba)

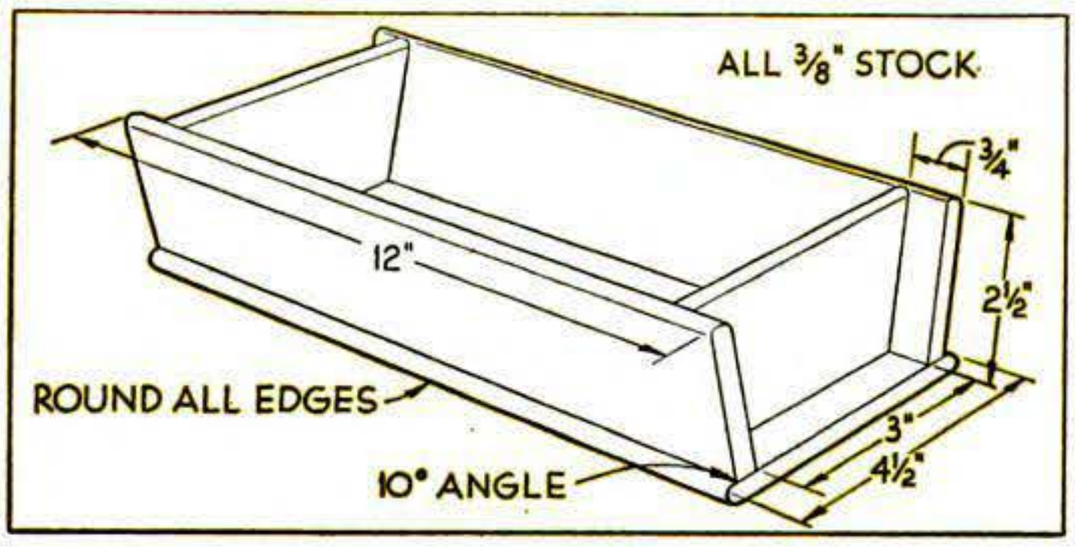


Rancho Camulos, 1850
(Ygnacio del Valle)



Rancho Los Verdugos, 1836
(Maria Verdugos)

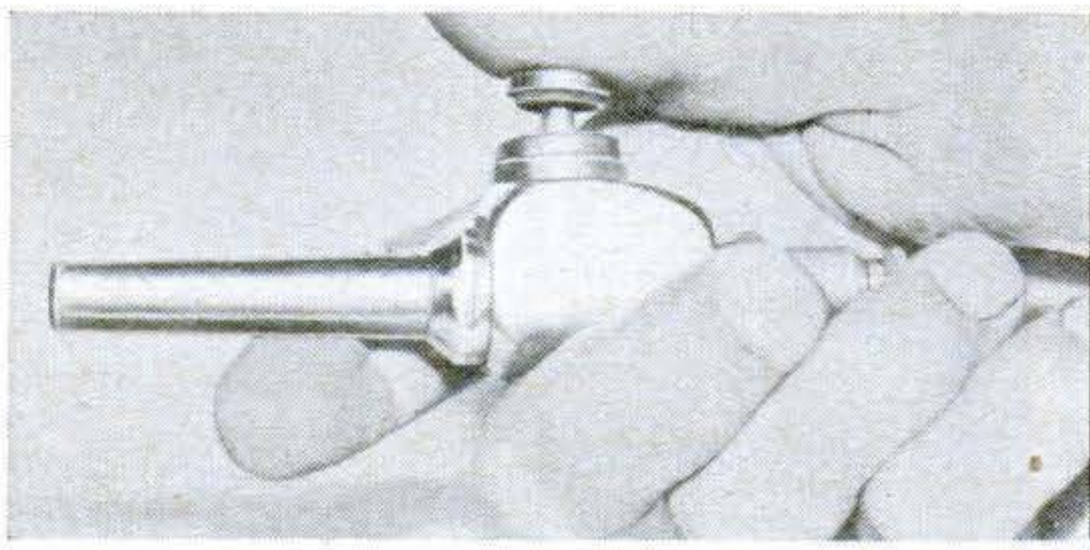
BRANDING-IRON designs and horseshoe handles lend an air of the Old West to this snack or barbecue tray. It's made of ⅜" white pine, providing plenty of contrast with the burned-in ranch brands. Using ¼" squares, trace the brands three to a side and burn them in with an electric pencil, small soldering iron, or heated nail held with pliers. The horseshoe handles are laid out on ⅜" stock with 1" squares. Cut the toe calks of ⅜" pine and glue them to the shoes.

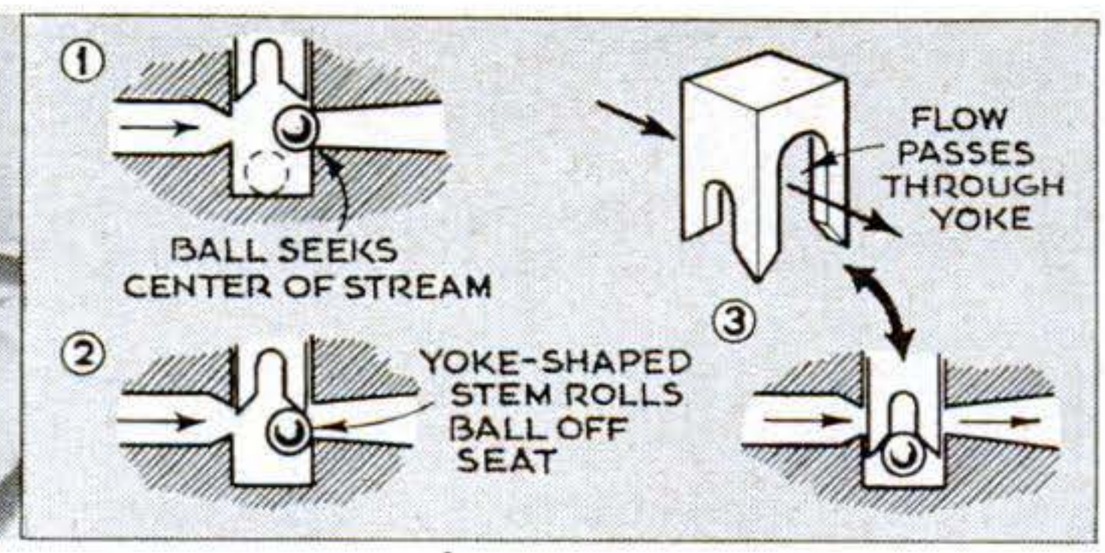


Each of the designs pictured above is a copy of an early California ranch brand. Beneath each is the ranch name, the date the brand was registered, and the owner's name. For reference, that information may be burned into the bottom of the tray.

After burning in the designs, assemble the tray with glue and brads. Sand it smooth and round all edges. The shoes are stained brown and attached to the tray with glue and brads. Finish the tray with two coats of clear shellac, sanding lightly between each coat.—*Whitney K. Towers, Los Angeles.*

Springless Valve Controls Powerful Air Blast





PACKLESS and springless, this general-purpose air valve opens with very little thumb pressure and instantly snaps shut when the plunger is released. It's made by Paul Valve Corp., New York City, for ⅛" or ¼" hose and up to 100 lb. per sq. in. pressure. The plunger rolls the ball out of the seat. Pressure pops it back when plunger is released.

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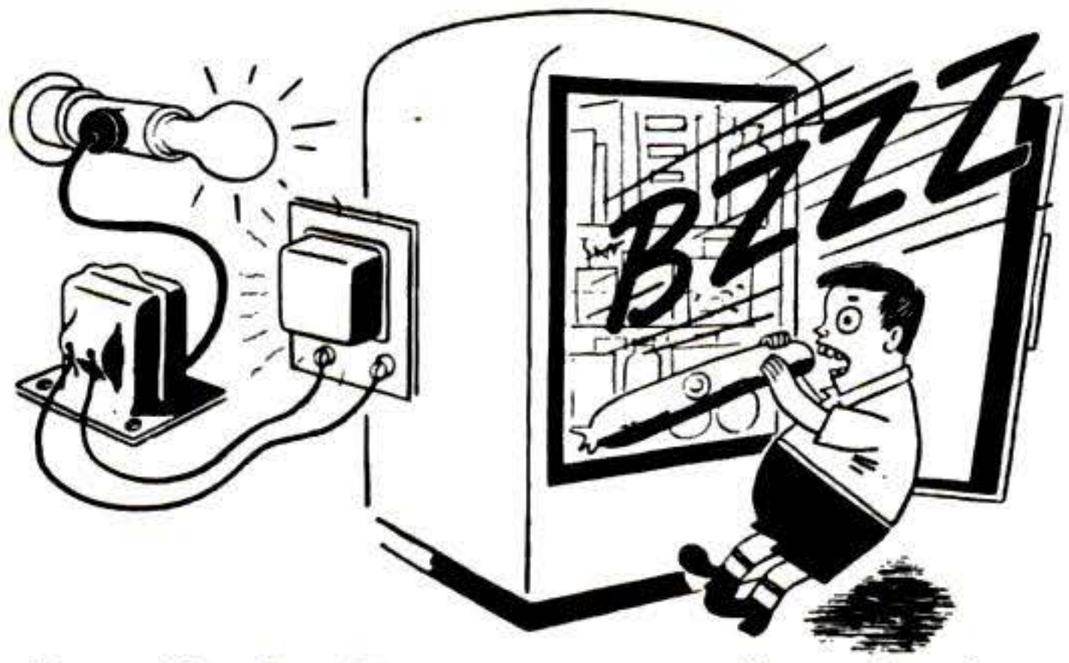
What's Your Ingenuity Quotient?



Our little Buster, a confirmed refrigerator raider, would march away with a yard or so of salami over his shoulder and always leave the door open. Now this rig sounds the raid alarm. I hooked up a buzzer and bell transformer, plugging the latter via a side-outlet socket into the interior refrigerator light. It uses current only when the door is open. It scared Buster so badly we couldn't drag him near the box for two days. —*Steve Walton, White Plains, N. Y.*

I was driving along the highway when a cotter pin let go, allowing a clevis pin in the accelerator linkage to drop into the splash pan. The problem then was to get down into the narrow space between the engine and fender to retrieve the pin. I couldn't reach it with my hand so I disconnected the windshield-wiper hose, started the engine, and used the hose as a vacuum cleaner to pick up the pin.—*John L. Rondeau, San Fernando, Calif.*

There was no valve to stop the water that was pouring from a storage-tank delivery pipe, and my wife kept saying I'd better do something about it. "Don't worry," I told her, "it's in the bag." So I put a bottle of soda pop, neck down, in a small cloth bag. Then I tied a line to the bag and lowered the whole business into the tank. The neck of the bottle entered the outlet pipe, cutting off the flow enough so I could make the repair. Then I drank the pop.—*Robert Carabin, San Antonio, Tex.*

Our dog, Butch, had insomnia. This made him very irritable. We tried everything and finally decided he needed an inner-spring mattress. I couldn't find such a mattress to fit his kennel. Then I hit on this. I put an old 600 by 16 inner tube inside a feed sack, closed the neck of the sack, and pumped up the tube until it stretched the sack drum-tight. Now Butch has a good sleep every night.—*Clarence Waas, Winchester, Ky.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

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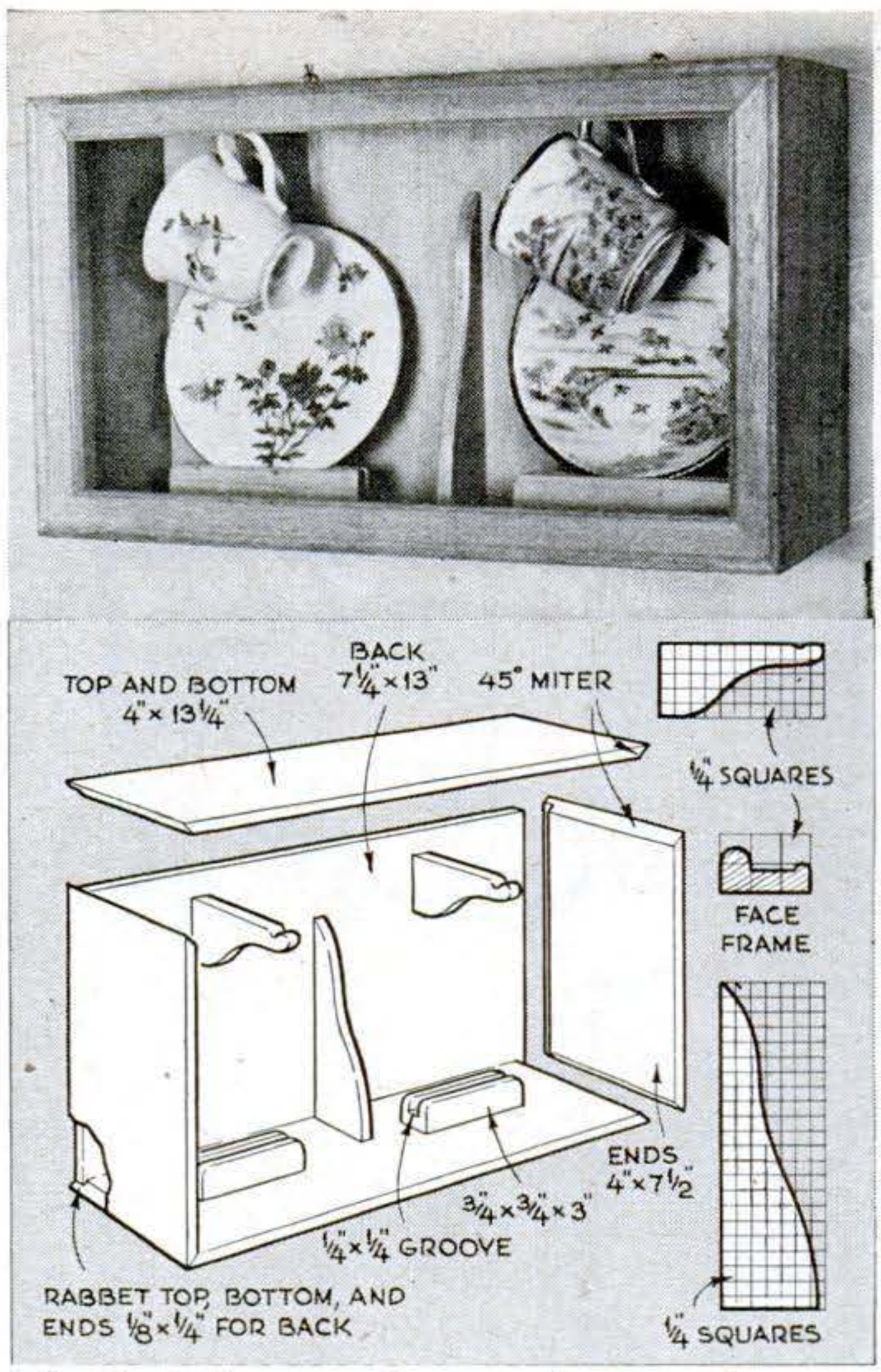
Shadow Box Shows Off China

For fine pieces of china, a shadow box is needed to show them off to best advantage. This one was built of ¼″ mahogany plywood, with the face frame of solid stock.

Cut the top, bottom, and ends 4″ wide and to the lengths shown in the drawing. Then rabbet the back edges ⅛″ by ¼″ to receive the 7¼″ by 13″ back. After mitering the top, bottom, and ends, glue them and the back in place. By gluing the back in at the same time as the other pieces, you'll have no trouble in squaring the box.

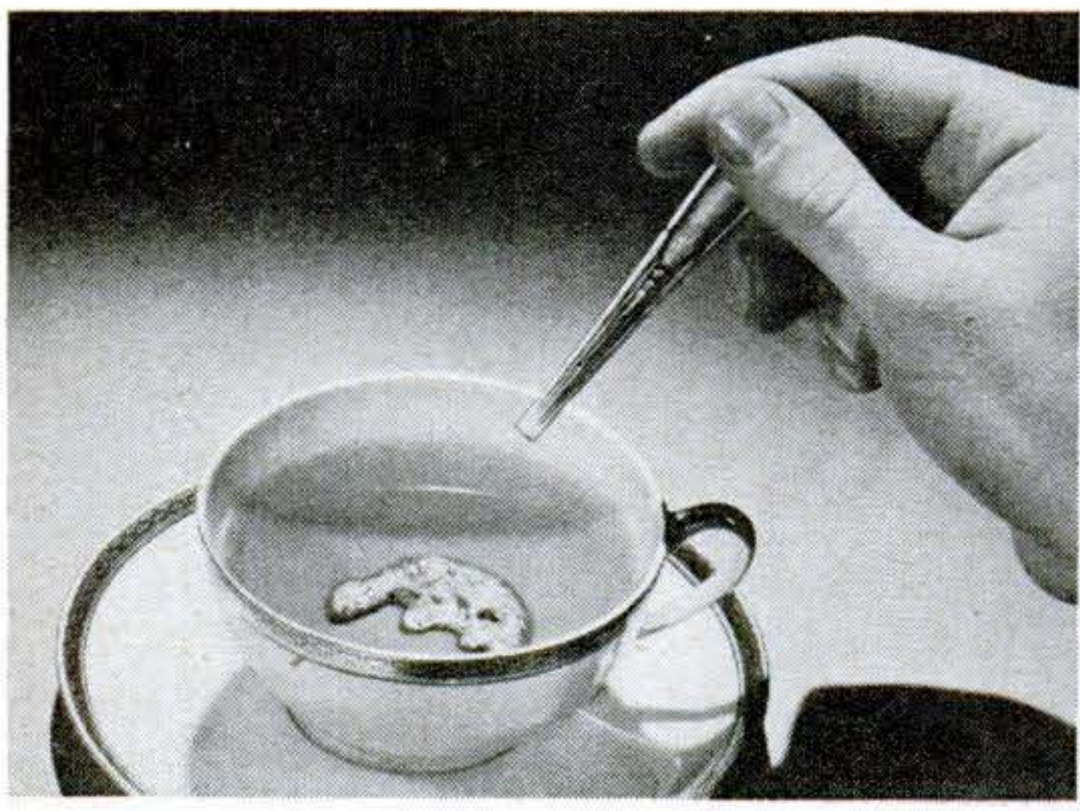
Follow the pattern given for the narrow face molding, or shape it to suit yourself. This may be bradded to the front of the box, but for a real professional-looking job, glue it in place.

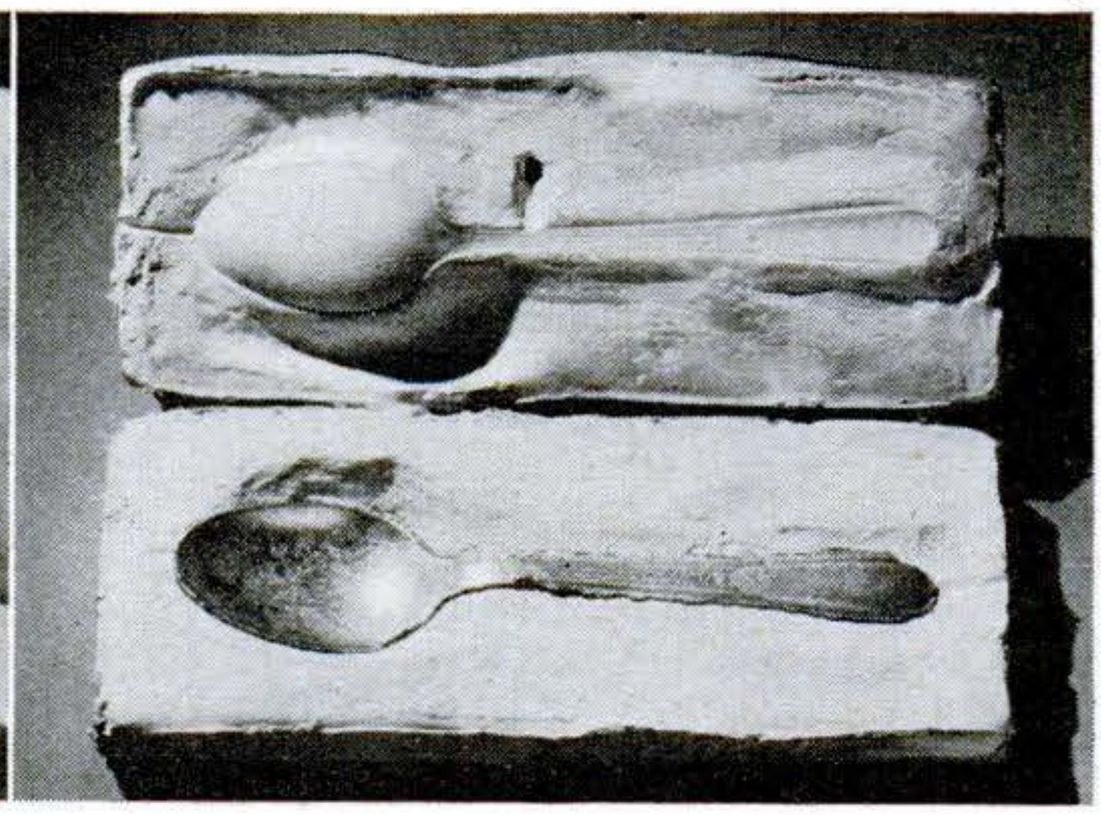
After laying out and sawing the cup hooks and divider to shape, sand them smooth. They are fastened from the back with small screws. Dado the grooves in the saucer holders, or saw and chisel them out. Those pieces are held by screws through the bottom. Finish the interior of the box before screwing in those parts.—*Whitney K. Towers, Los Angeles.*



Finished showcase for pair of cups and saucers was cut and built from ¼″ mahogany plywood.

Homemade Trick Spoon Will Vanish in Hot Tea





This might be called the Case of The Disappearing Spoon or, Who Put Wood's Metal in Aunt Minnie's Tea? Here's how you make a spoon that acts like the one in the photo: Pour 1″ of plaster of Paris in a 2″ deep box. When it's like putty, coat a spoon with salad oil and press it into the mix but don't submerge it. When hard, oil the surface and fill the box with plaster. Later you can lift the top off the mold. Cut a pouring hole in the top and a vent at one end. Pour in molten Wood's metal, which melts at 160 deg. F. and can be bought at a chemical supply house. Polish the trick spoon with fine steel wool. (A power buffing wheel would melt it.) Now slip it into the saucer of someone's teacup and watch the general surprise when the spoon melts. Don't let anyone drink the tea. The metal can be recast.—*J. W. Carr, Bellmore, N. Y.*

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Speedy Kayak Built in Jig

By Hi Sibley

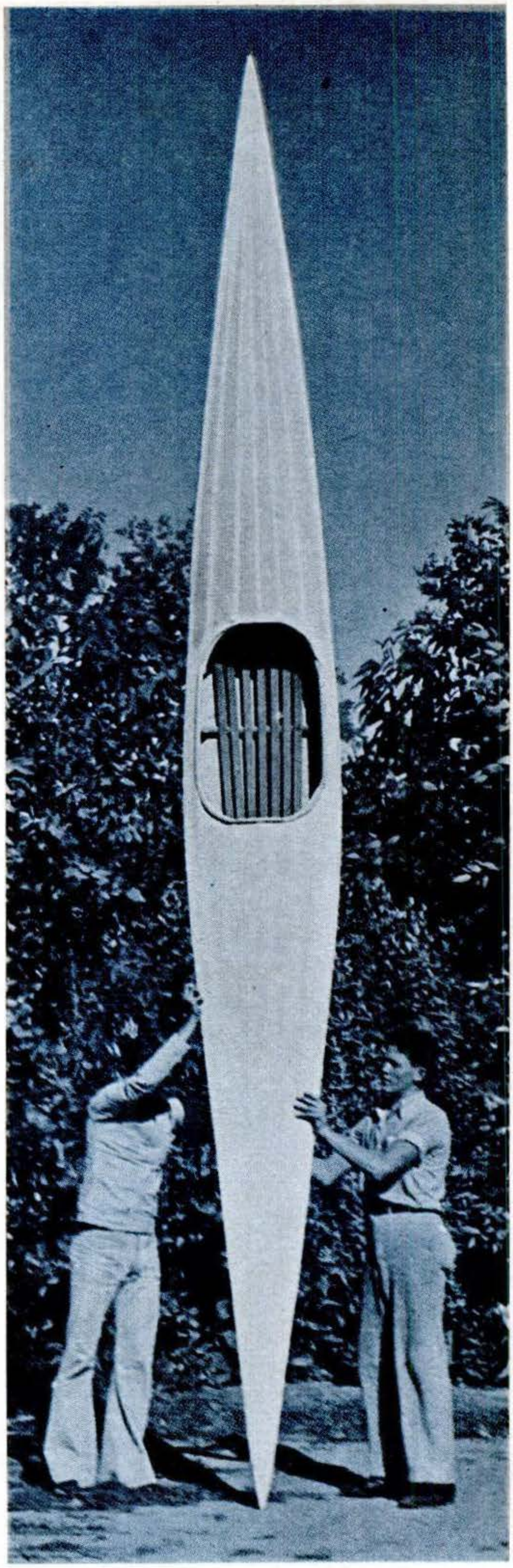
WHEN your girl paddles around in this boat, it's an umiak—not a kayak. It may sound like double talk, but the Eskimos who originated this type of craft call a man's boat a kayak and a woman's an umiak. The one shown here is designed primarily for speed but it handles safely in fairly rough water because of its length and the high coaming.

The frames are ½″ marine plywood and the battens are spruce. The whole business is covered with 8 oz. duck, making a light, strong boat. For ease in building, the framework is assembled upside down on a jig. The jig is a 2″ by 8″ plank supported on uprights, Fig. 1 on the next page. Notch the plank for the frames and cut it at the ends for the stems. To get the plank out of the frames, saw it in two. Note in Fig. 2, the deck plan and outboard profile, that all frames are spaced equally.

First step is to saw out the frames to the dimensions given in Fig. 3. Lay out the work on a plywood panel, checking before you cut to be sure waste is minimized. The deck beams, also shown in Fig. 3, are ½″ by 1½″ pine cut on a 40″ radius.

Make the stems of pine for lightness. The stem profile in Fig. 4 shows the locations of the notches for the battens and keelson. Cut back the stems for the keelson and bevel the front edges as indicated.

Drill holes in the stems to screw them to the jig during construction. With these and



Clean lines and exceptional length are two outstanding features of this fast, sturdy kayak.

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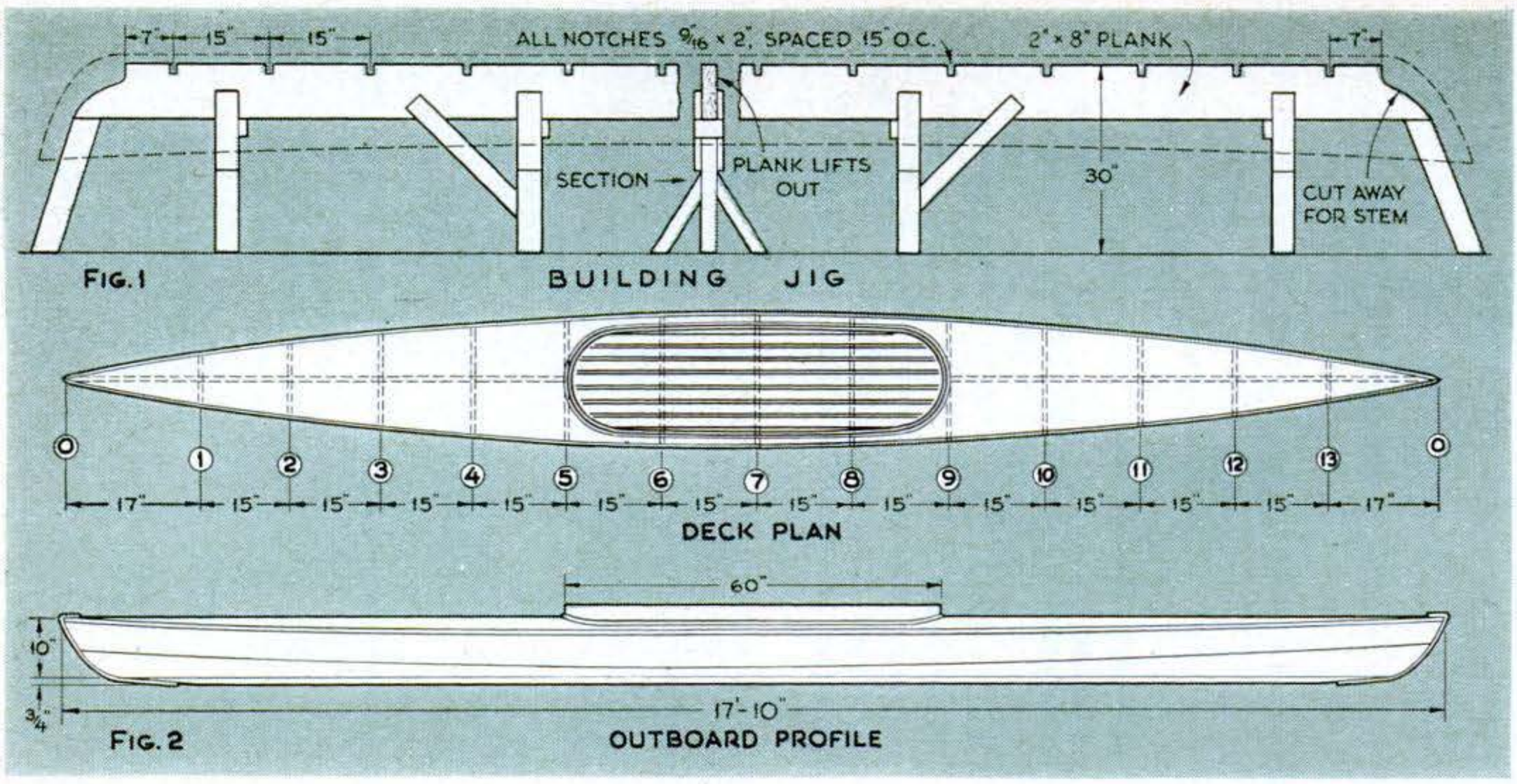
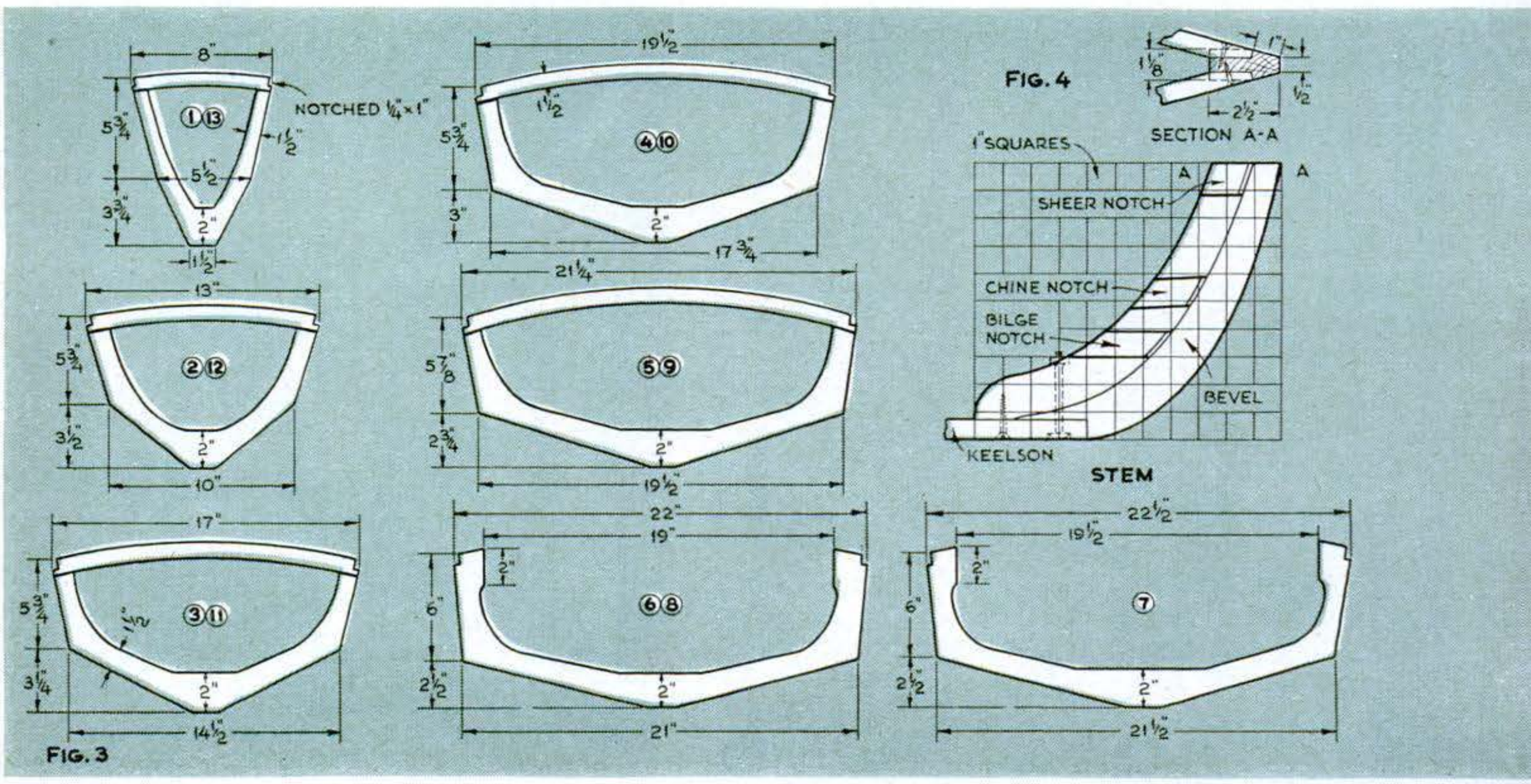


Use of jig simplifies building by holding frames in place until they are joined to battens.

all the frames in place, the keelson can be installed. Put a screw through the keelson into each frame. Locate them off center to make way for the screws to hold the keel. It is put on last, over the canvas. Next put on the sheer battens. Begin at Frame No. 7 and work toward the ends, alternating from side to side of the kayak with the screws. Follow with the chine and bilge battens.

At this point take the boat out of the jig and turn it right side up to complete the deck beams and cockpit. A general view of assembly is shown in Fig. 5. Deck beams are fastened to the frames with a screw at each end. Note that Frames No. 6, 7, and 8 are left open with a sub-coaming extending from No. 6 to 8 on each side. Filler boards complete the rounded portions between Frames No. 5 and 6, and 8 and 9. One filler board is shown in greater detail in Fig. 6. Put in the sub-coaming but leave the true coaming until after you've put on the canvas. Screw the ⅜" by ½" tacking strip in place as in Fig. 8. The flooring is ⅜" by 1¾" stock.



Deck beams bridging frames are ½" by 1½" pine cut on 40" radius. Frames are plywood.

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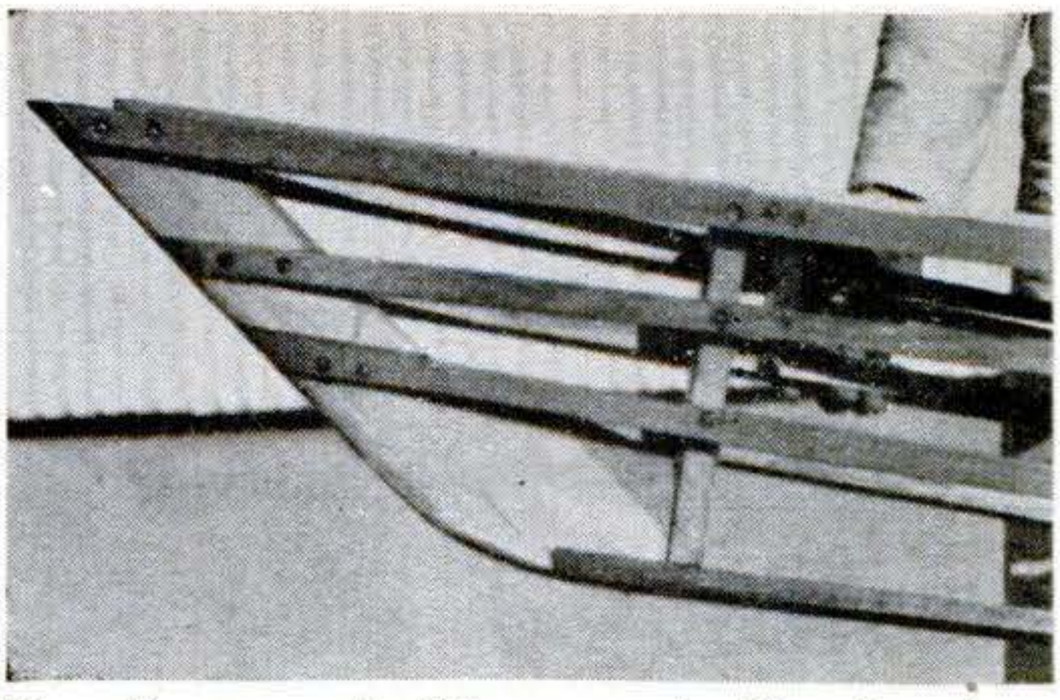
After screwing on the longitudinal deck battens, you're ready to put on the hull canvas. You'll need a piece 1 yd. wide and 6 yd. long. Lay it over the frame and tack it in three places along the keelson. Next draw it over the chines and tack it temporarily on the sheer battens amidship. Wet the canvas and pull it lengthwise over the stems and again tack it temporarily there.

As the canvas dries it will shrink and take the shape of the framework. When it's dry, remove tacks and canvas. Apply marine glue along the bottom of the keelson and on the bevels of the stems. Replace the canvas, putting in tacks about ¾″ apart. Then draw the duck up over the chines and on over the tops of the sheer battens and tack it there. The marine glue should be applied just before you tack on the canvas. Figure 7 shows how the duck is lapped on the stems and later covered with a brass strip.

Next comes the deck canvas. For this you need a piece 2′ wide and 6 yd. long. Lap the deck canvas over the hull canvas and tack it in place. Cover the entire top of the kayak, including the cockpit. Wet the canvas and put weights on it over the cockpit opening. This will take up any slack.

Leave the weights in overnight. When the canvas is dry and with the weights still in place, tack it all around the top of the sub-coaming and on the curved tacking strips. Then with a razor blade or sharp knife, cut away the duck over the cockpit.

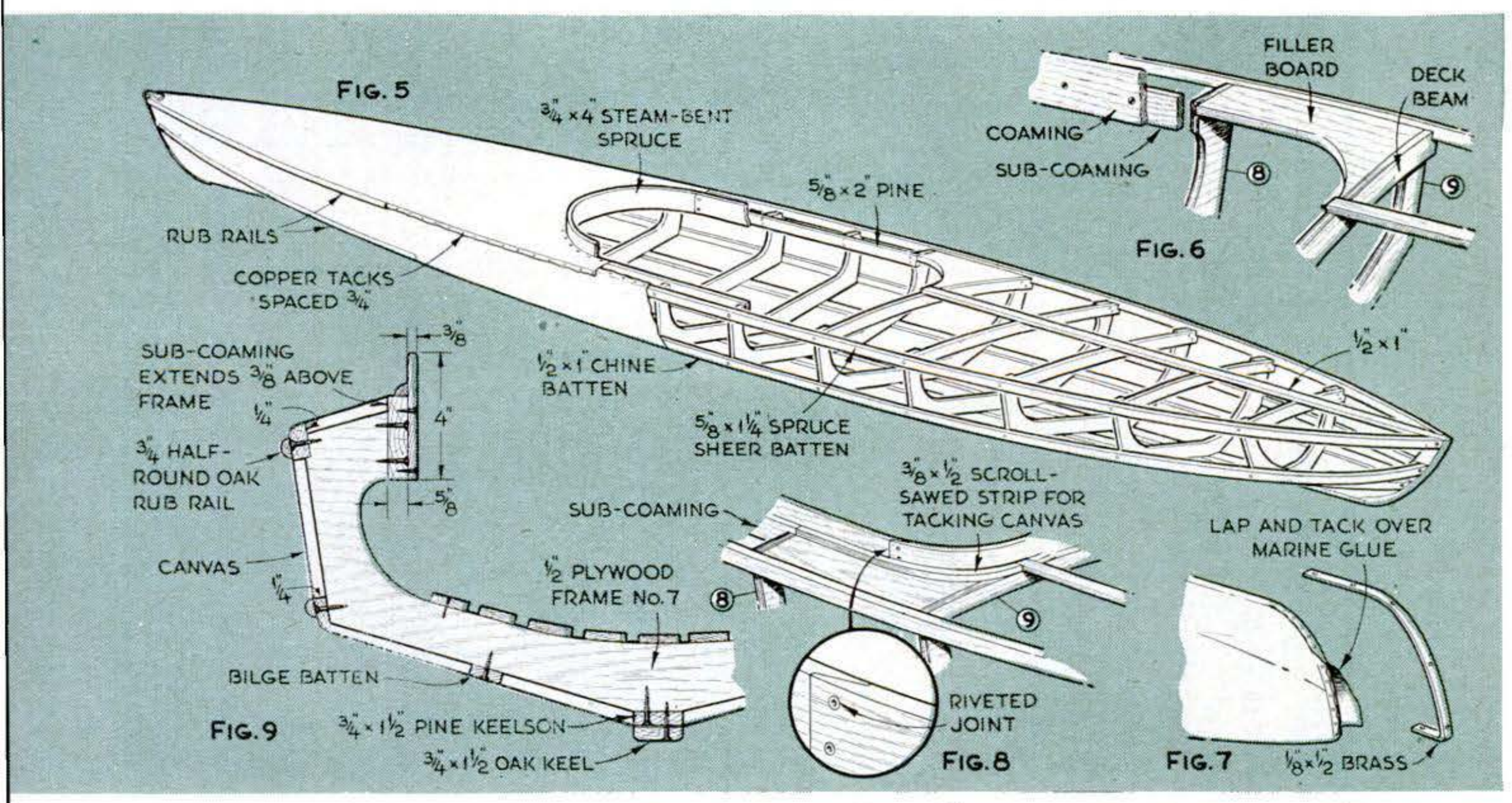


Here is one end of framework. Note how battens are faired into the notches cut in the stem.

Installation of the true coaming is next. Make the lap for the riveted joint as shown in Fig. 8. Steam ⅜″ by 4″ by 48″ pieces of spruce. Bend them around a form with an 8″ radius. Apply marine glue and screw the pieces to the sub-coaming. Then screw quarter-round molding over the tack heads all around the cockpit.

Apply a coat of canvas cement over the entire skin. When dry, sand it lightly and finish with a coat of deck paint and a flat color. Sand it again and varnish it. Then screw the oak rub rails on the sheer and chine battens. The true keel is put on last as shown in the sectional view, Fig. 9.

In case the canvas isn't as taut as you'd like before painting, you can make it as tight as a drum with airplane dope. Then it needs only one coat of paint and varnish. END



Principal construction details are shown above. Steam-bent coaming is put on after canvas.

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How an Expert Cleans a Typewriter

To keep typewriters working at their peak, Mr. Hoffmann cleans and oils them periodically. The process takes about a half hour and involves the steps shown in the following photos.

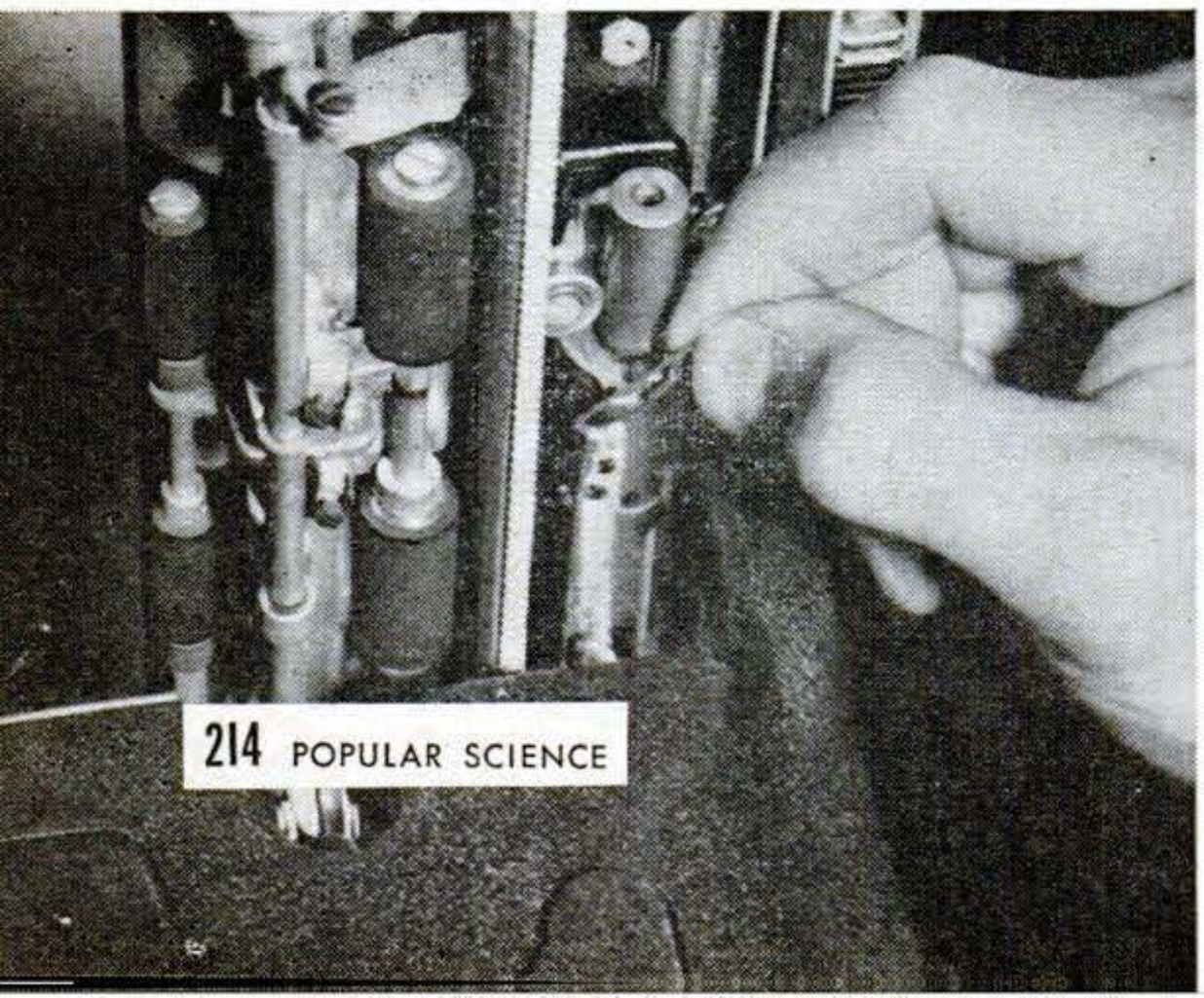
By Robert Gorman
PS Photos by W. W. Morris

FOR some years PS editors have watched quiet, competent Adolph Hoffmann nurse ailing office typewriters back to health. Always anxious to learn how an expert mechanic goes about his work, we recently took a good close look while Mr. Hoffmann cleaned an Underwood Model S.

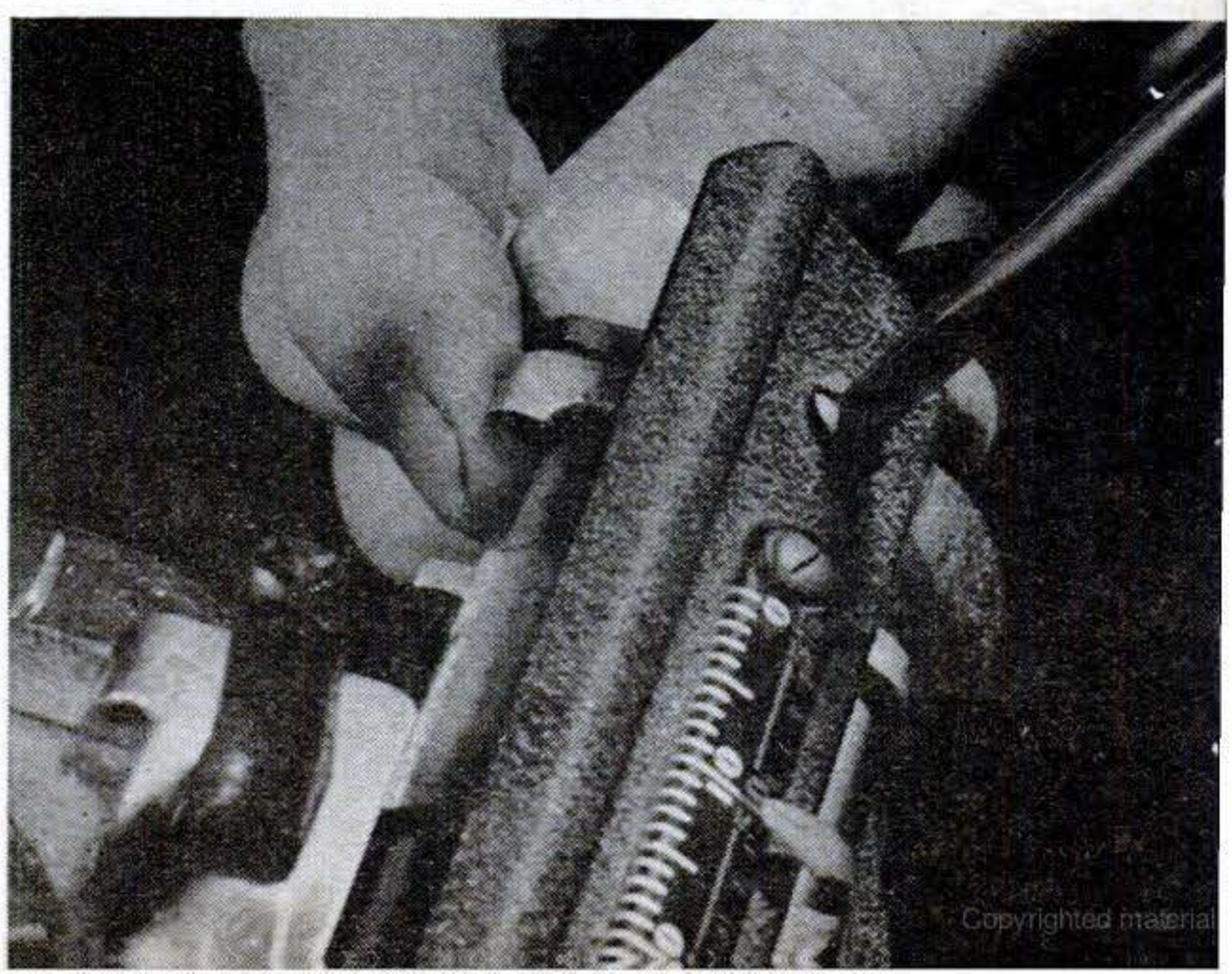
How expert Mr. Hoffmann is may be judged from the fact that he has been repairing typewriters for 43 years—since the days when rubber bands provided spring action for the early wooden rollers. For 27 years he's had his own repair service.

The dust that accumulates when writing machines are left uncovered is one of the biggest causes of sluggish operation. Another bad practice—of which most users are guilty—is that of allowing erasure grit to fall from the page into the type bars and connecting links. Recommended procedure is to push the carriage to one side when erasing. Well up on the list of troublemakers is the all-too-common practice of threading new ribbons incorrectly. This often disengages the automatic ribbon-reverse gears. Before replacing a ribbon, note carefully the direction of rotation of both spools and the position of the ribbon on the vibrator or ribbon carrier.

1. The drawband—the heavy cloth strip that winds on a drum to pull the carriage from right to left—must be removed from the carriage stud and fastened to a stud on the frame.



2. Removing the scale plate comes next. It is fastened by screws at each end. The one at the right also holds the carriage frame stop so it must be removed with special care.



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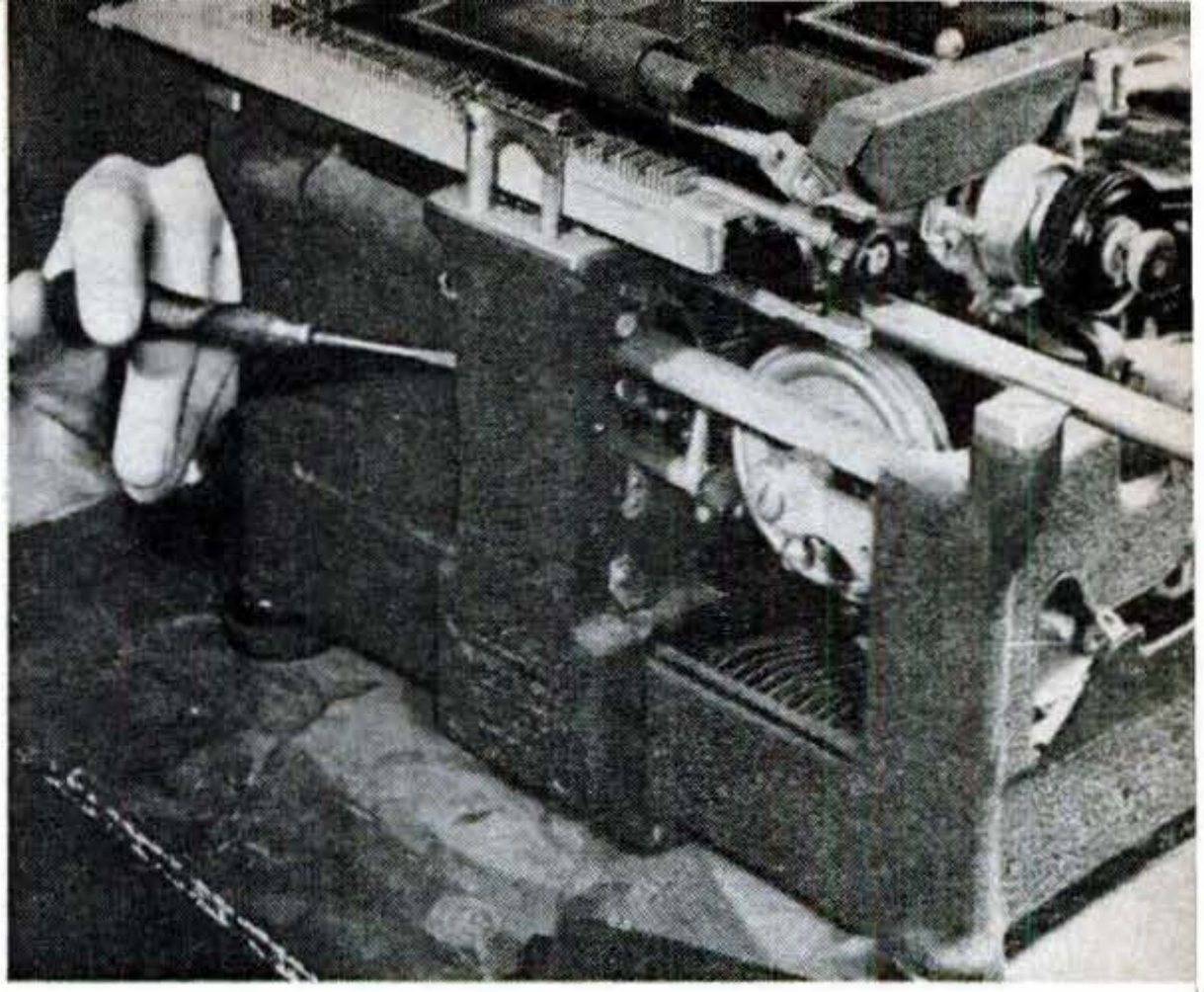
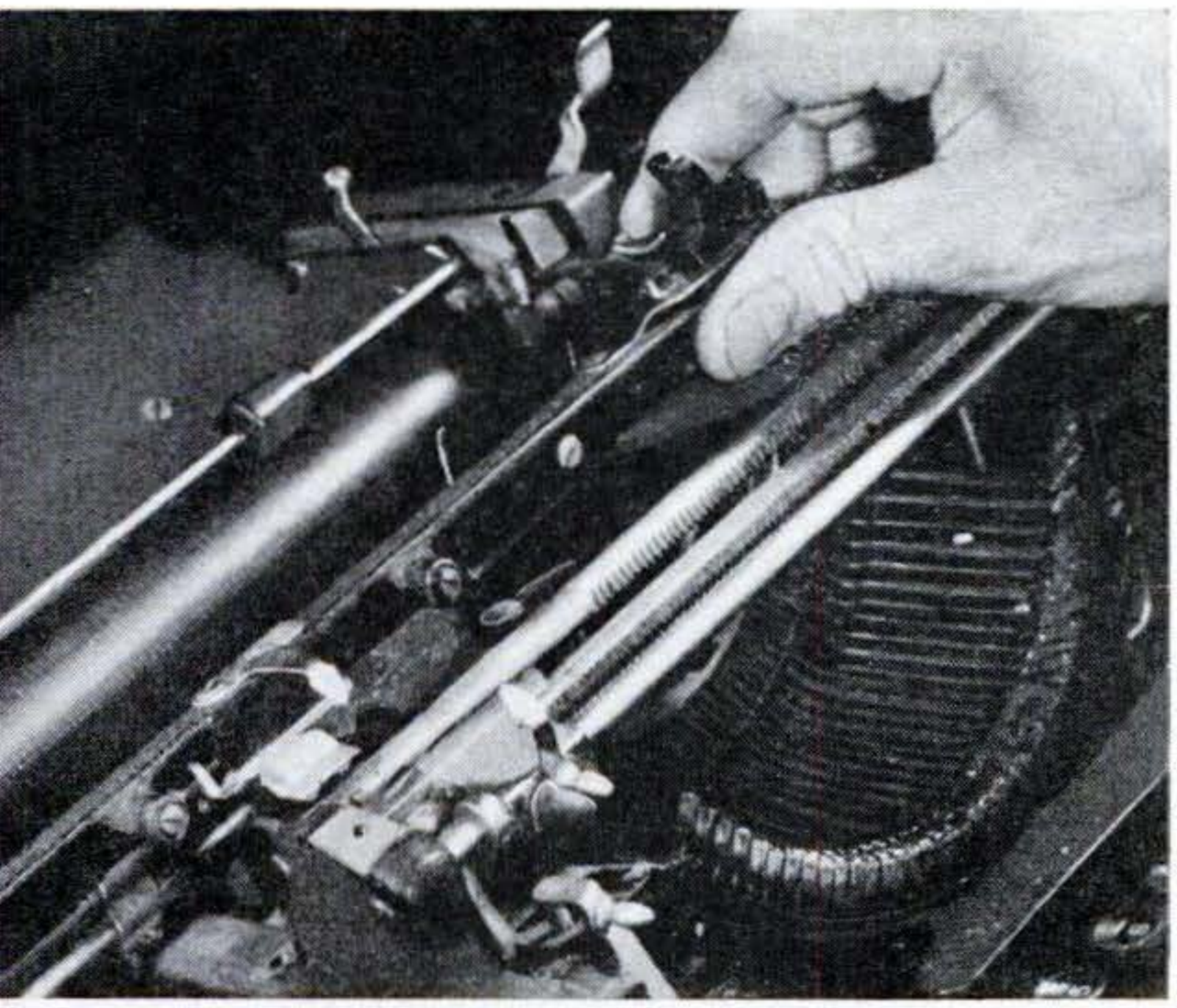
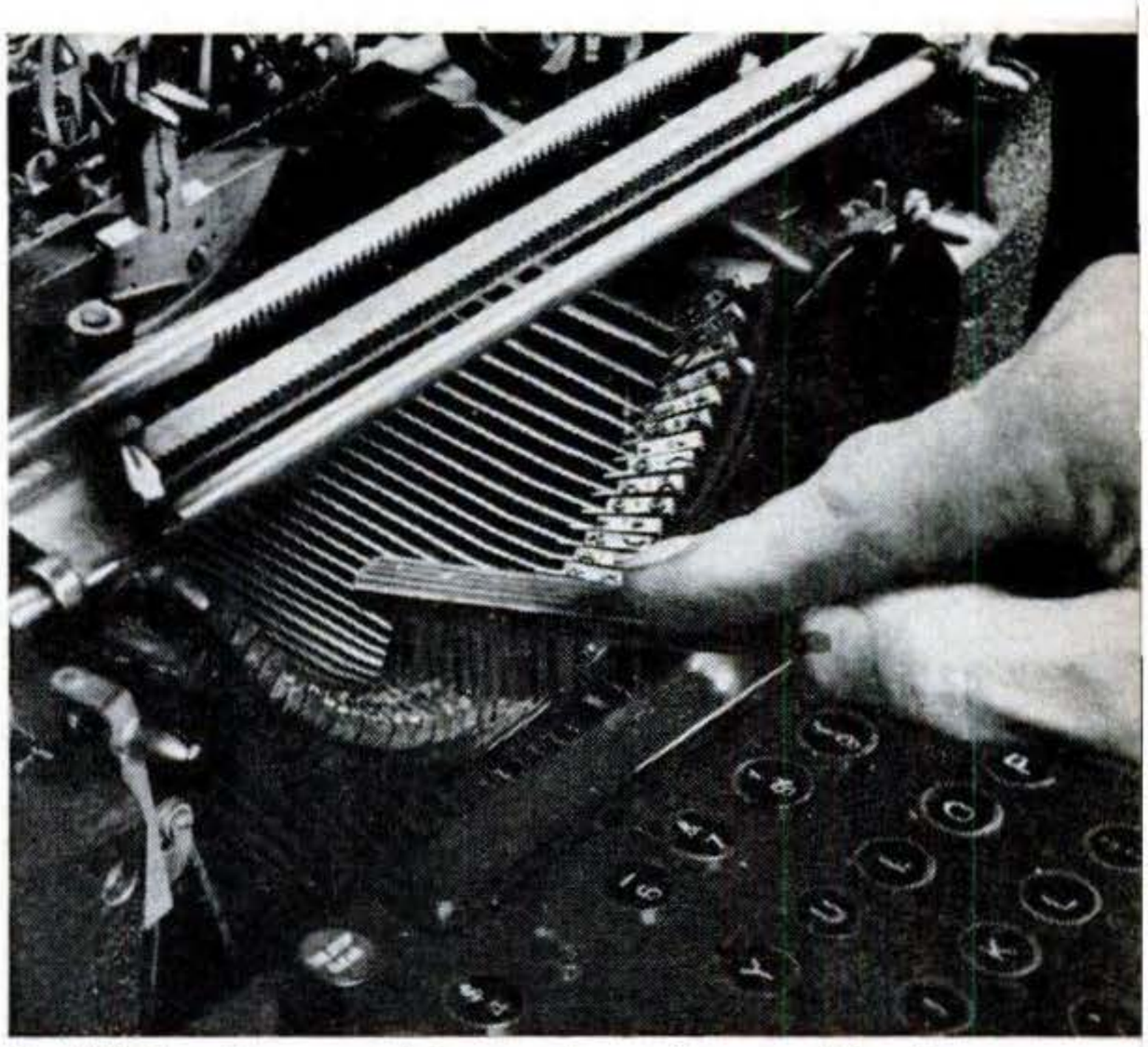
3. Cover plates then come off to make the inside accessible for cleaning. The name plate in front is pried off, being held only by plugs. Side and back plates are held by screws.



4. Taking off the left rear plate exposes the drum on which the drawband winds up. This plate and the one on the right are each held with two screws to the tabulator post.



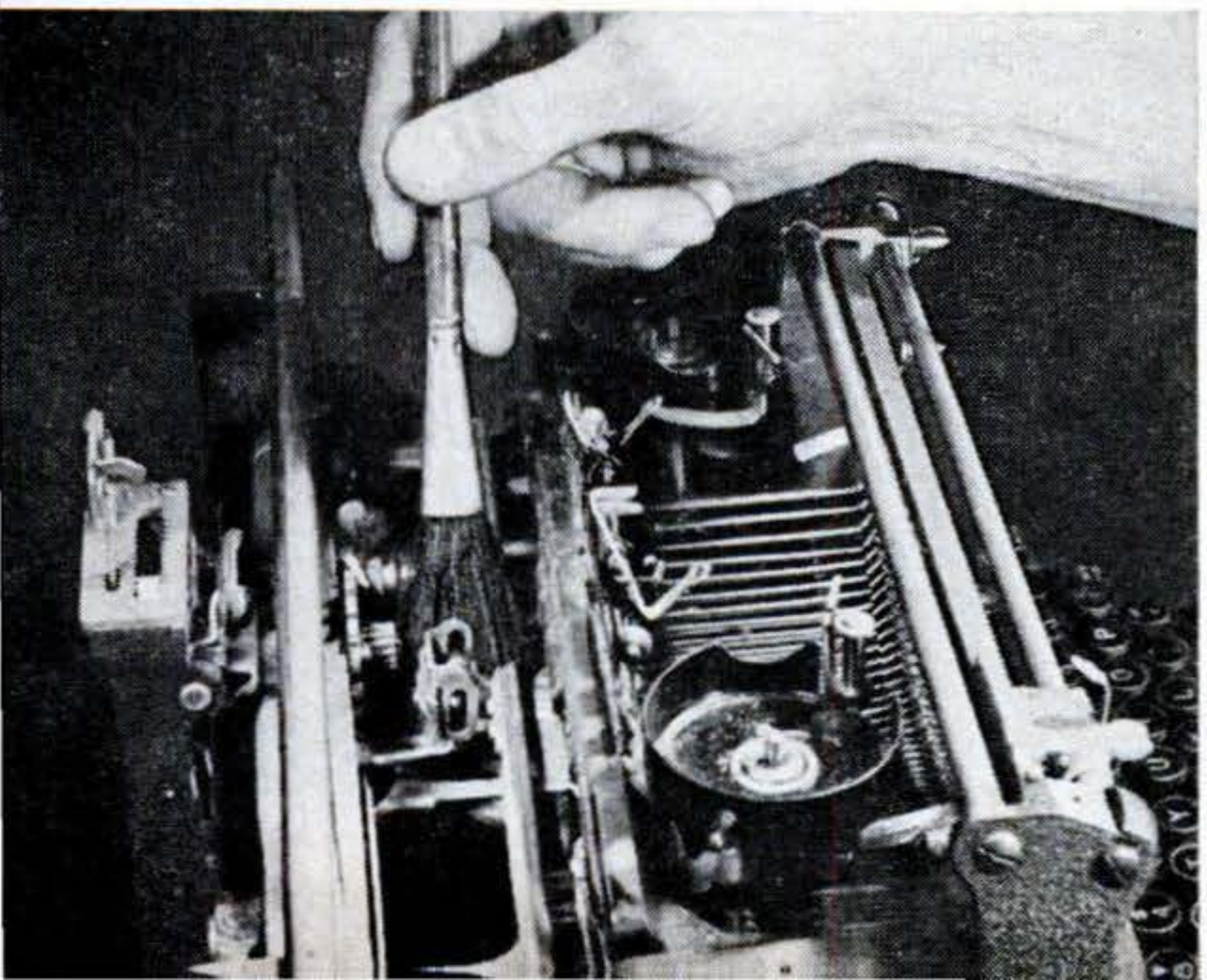
5. Lift the carriage and slide it to the left (on older models, to the right) to remove it. About half way it is tilted down to clear the brake-band guide. No forcing is necessary.

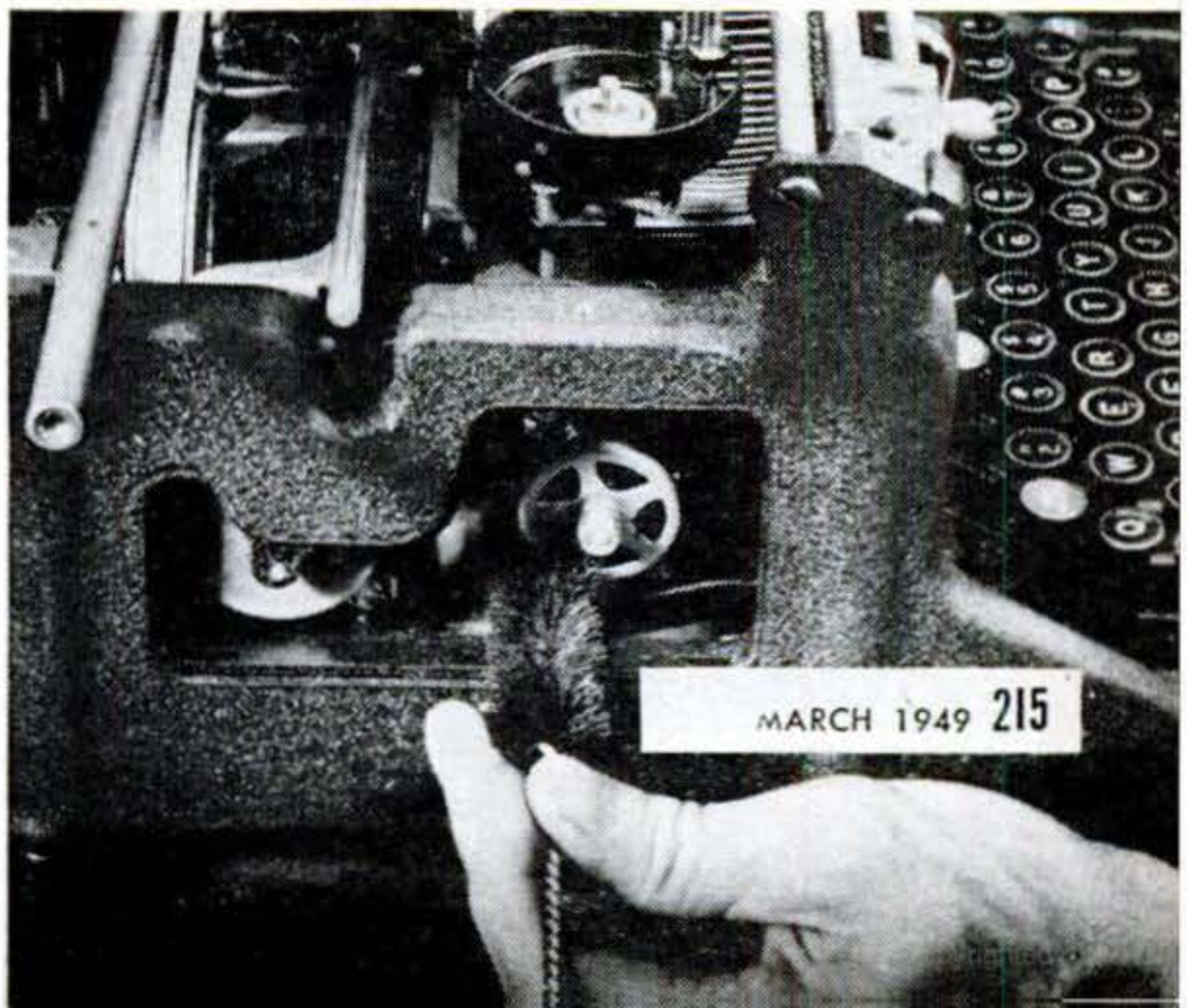


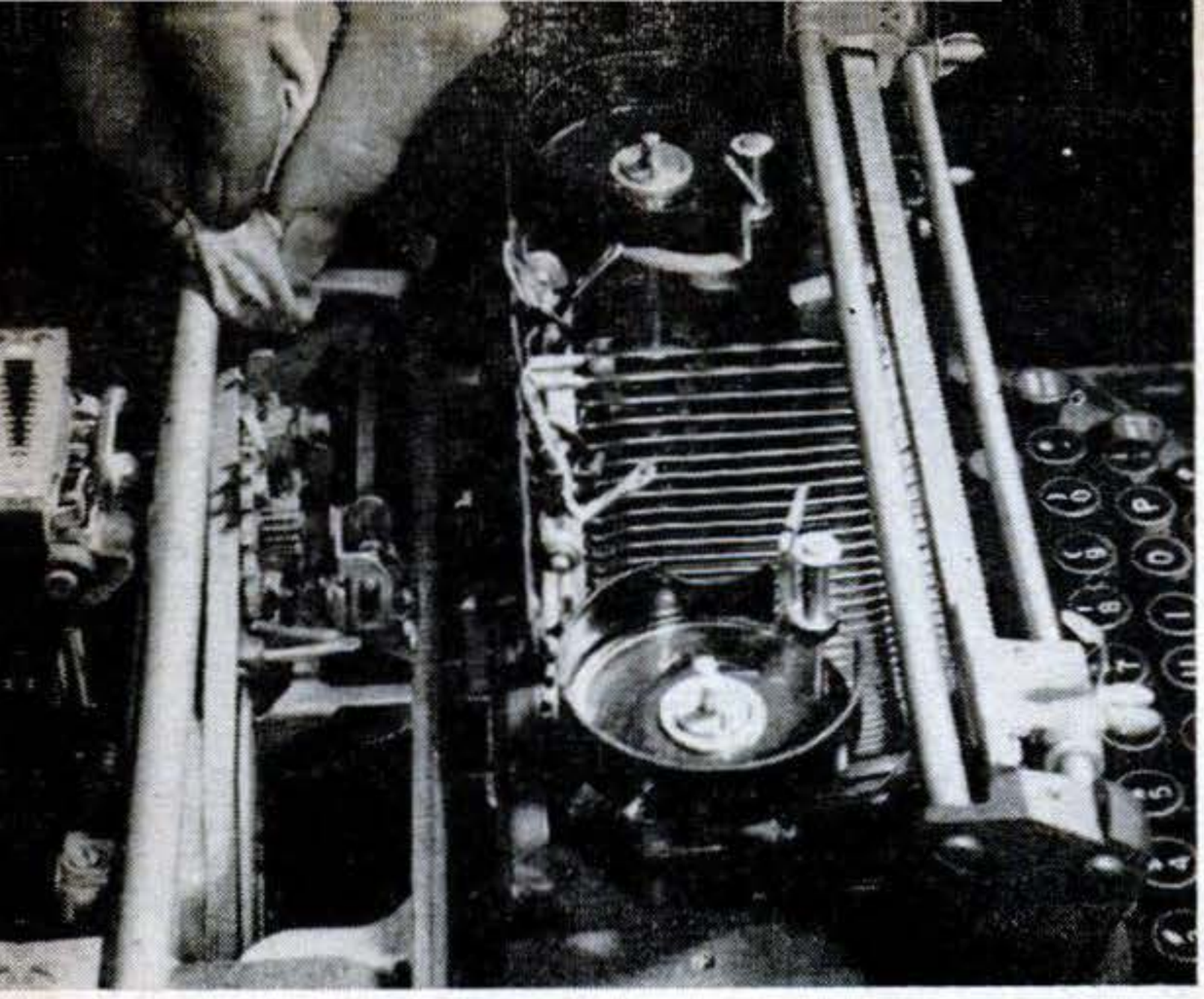
6. With the machine taken down this far, cleaning can begin. Type is brushed forward and back—never sideways. It's important to use good brushes. Loose bristles can cause trouble.

7. Brush the carriage bars and clean them with a cloth moistened in benzine. Use the cloth on the keys, too, in a front and back motion. Benzine doesn't cause gumming.

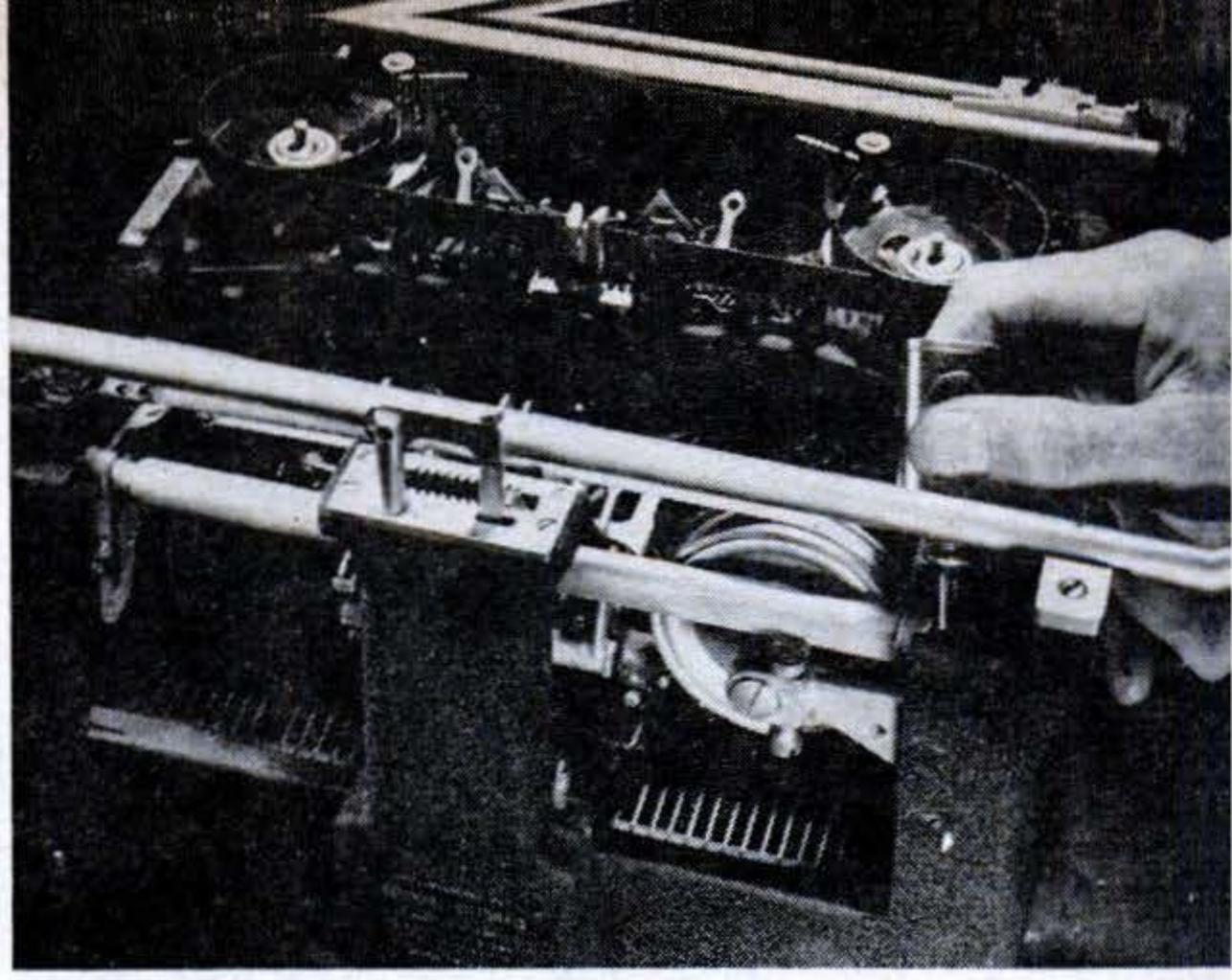
8. A baby-bottle brush, moved in and out gently from the left side, will get most of the loose dust out of the sublevers. Take it easy with the brush and never force it.



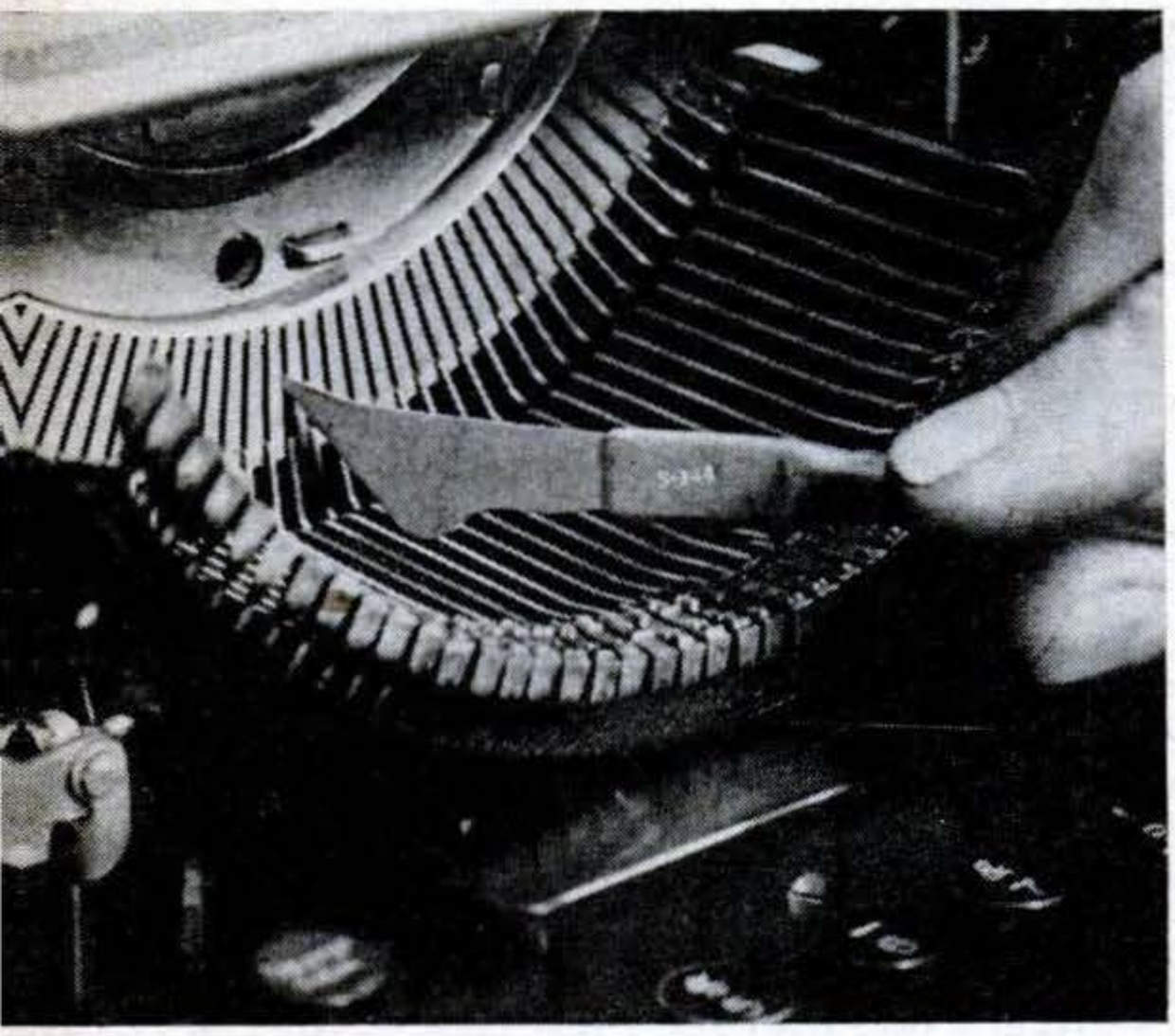




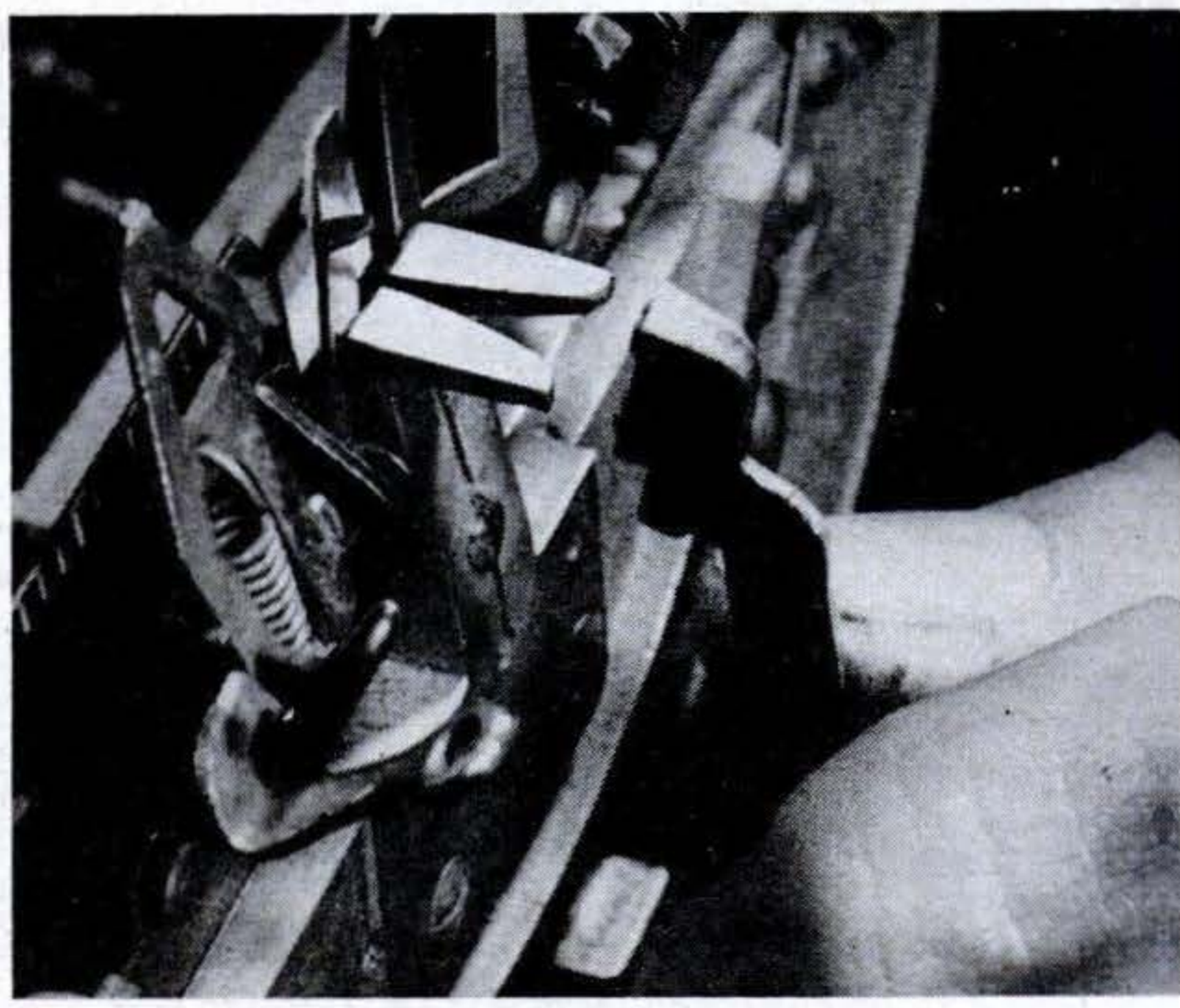
9. Cleaning the wayrod with benzine-dipped rag. The two front rails and the lift rail get the same treatment. A mixture of 2 parts benzine to 1 part light oil does a very good job.



10. Lift-rail pivots are being oiled. Also oil the universal bar (touching thumb) and other transverse rods. Use typewriter oil or mix 2 parts light machine oil to 1 of kerosene.



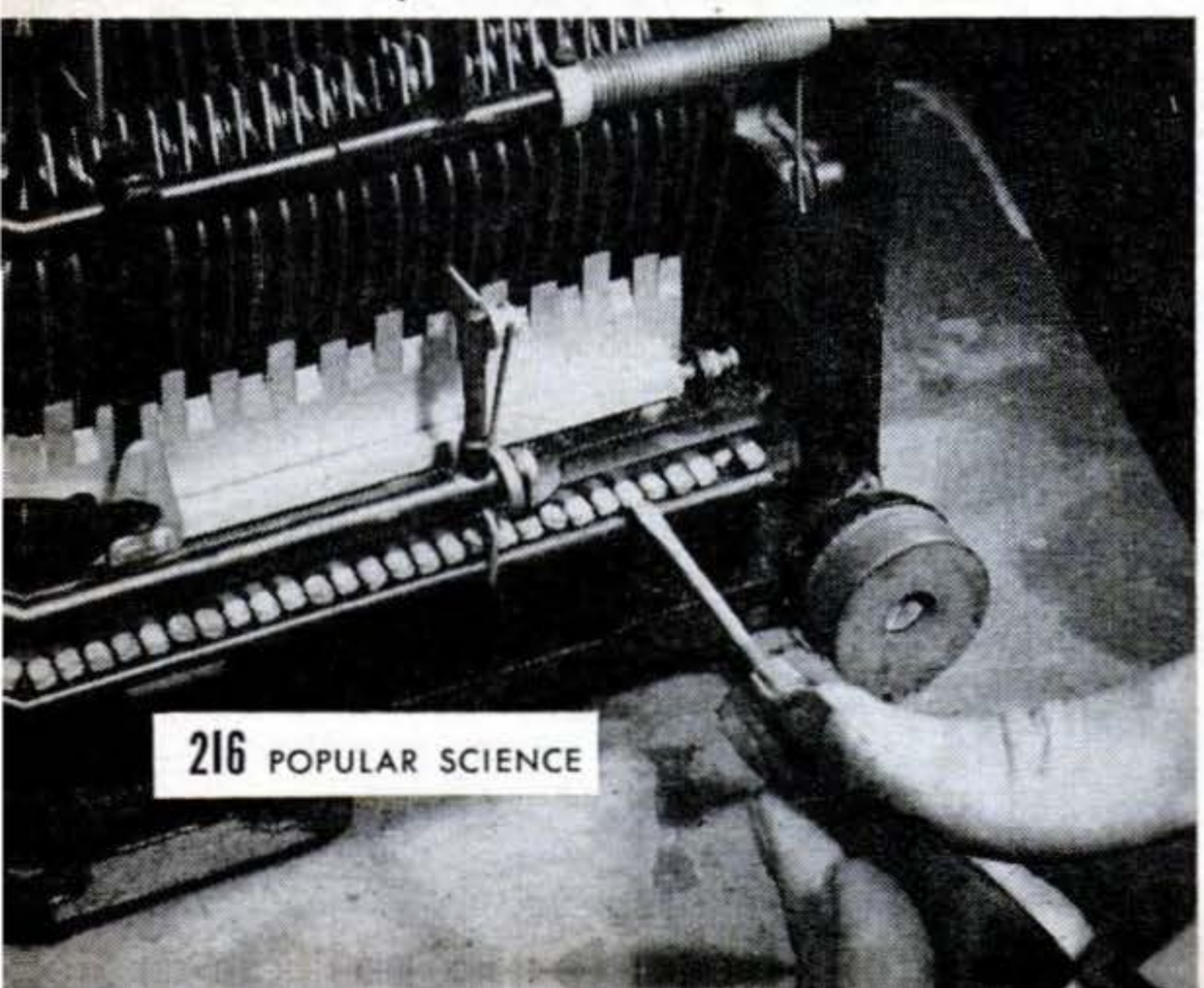
11. Dust and eraser grit may be cleaned from the type-segment slots with a special pick, a knife, or a toothpick. Finish by brushing the slots with the benzine and oil mixture.

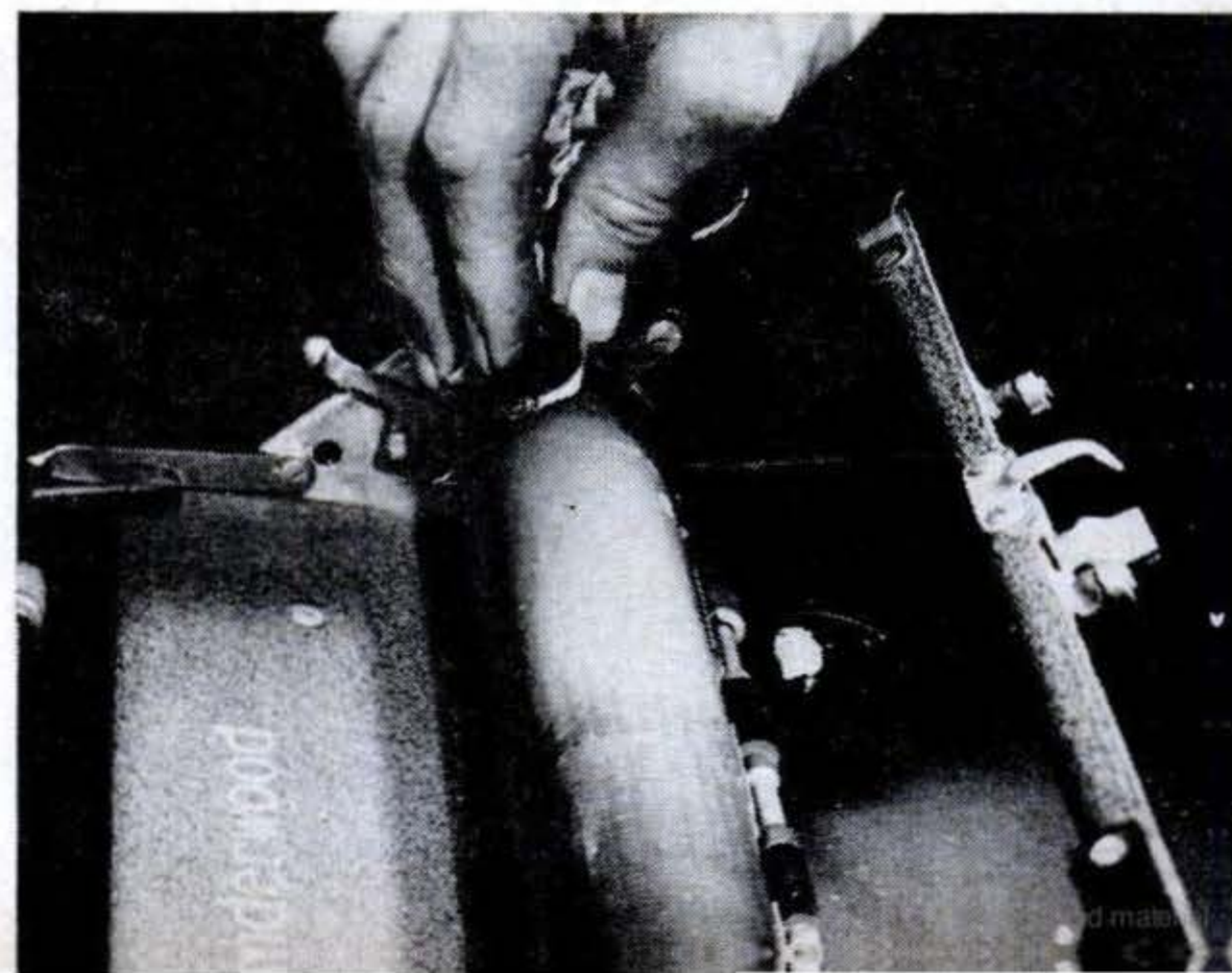


12. Keys that stick or jam because they hit the guide may be straightened by pressing the type bar gently between thumb and forefinger. Don't press the type head lest it snap off.

13. Key tension can be adjusted by tightening the screws along the lower rear edge of the machine. Trace the sluggish key to its screw and turn slowly. Test after each half turn.

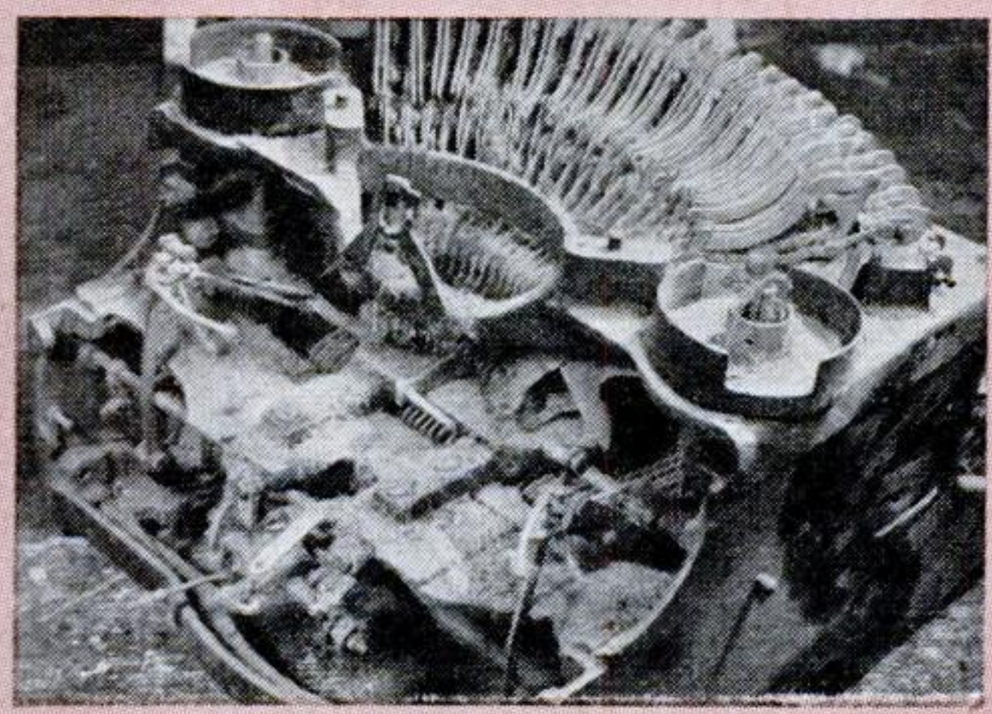
14. The platen, or rubber roller, becomes hard in constant use. Rubbing it with a rag dipped in lacquer thinner—or a benzine and alcohol mix—softens it for better paper grip.



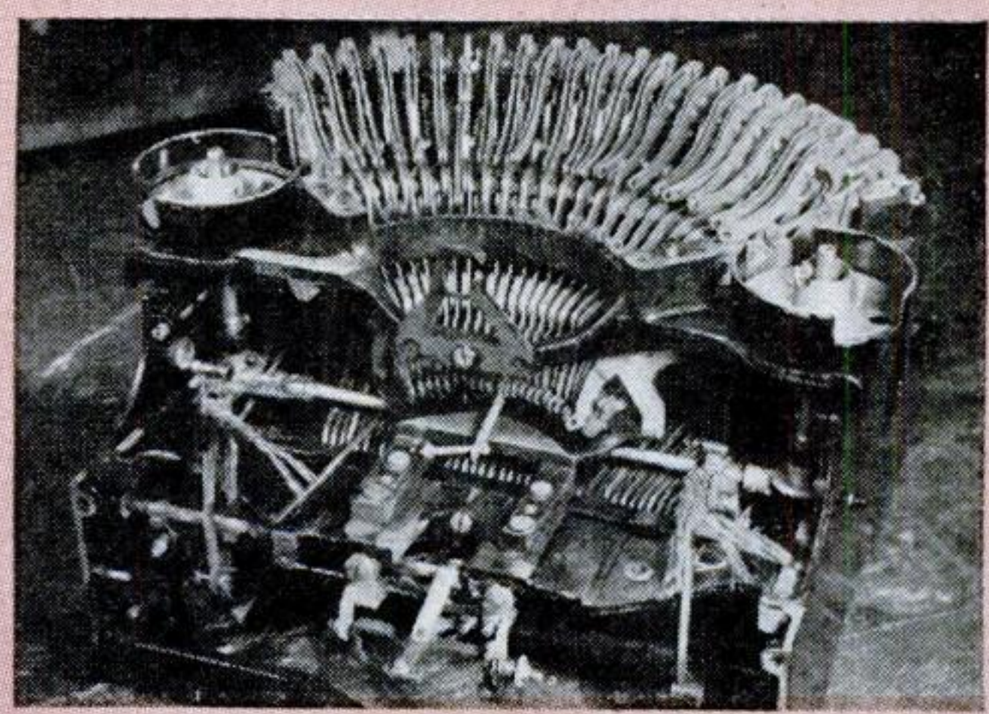


Machines Get Bath in Thorough Shop Overhaul

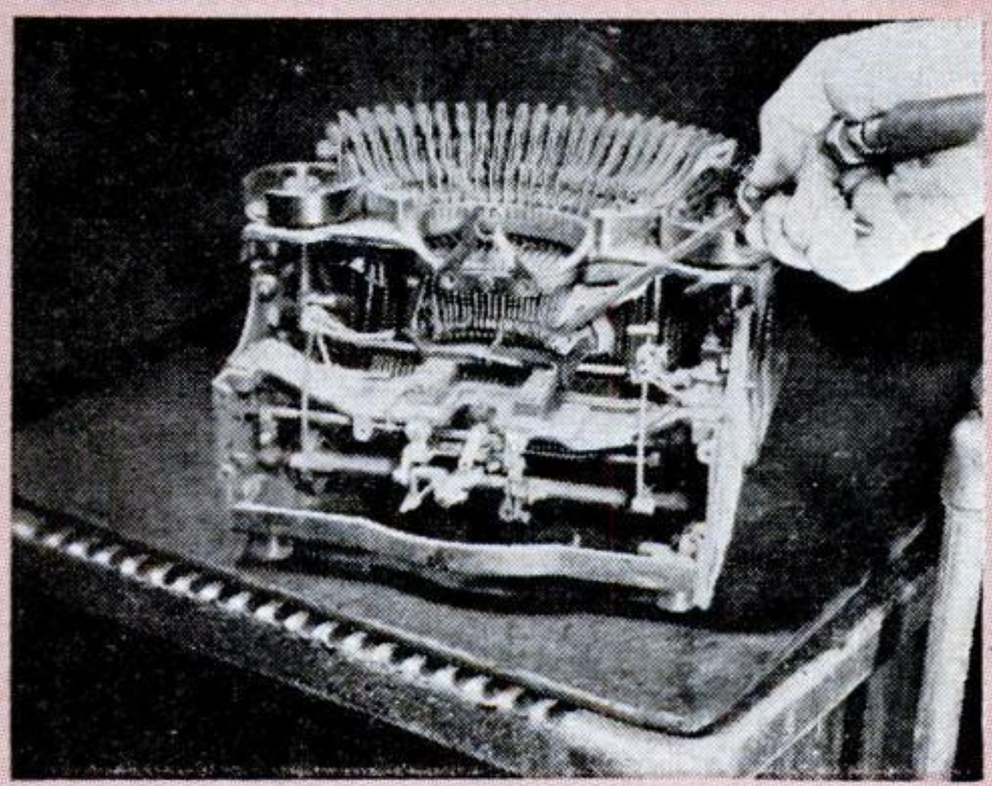
LIGHT cleaning of the kind pictured on the previous pages can be taken care of without removing the typewriter from its desk. In fact the expert doesn't even have to roll up his sleeves. A really dirty machine calls for different techniques. Here is part of the treatment it gets in Mr. Hoffmann's well-equipped shop.



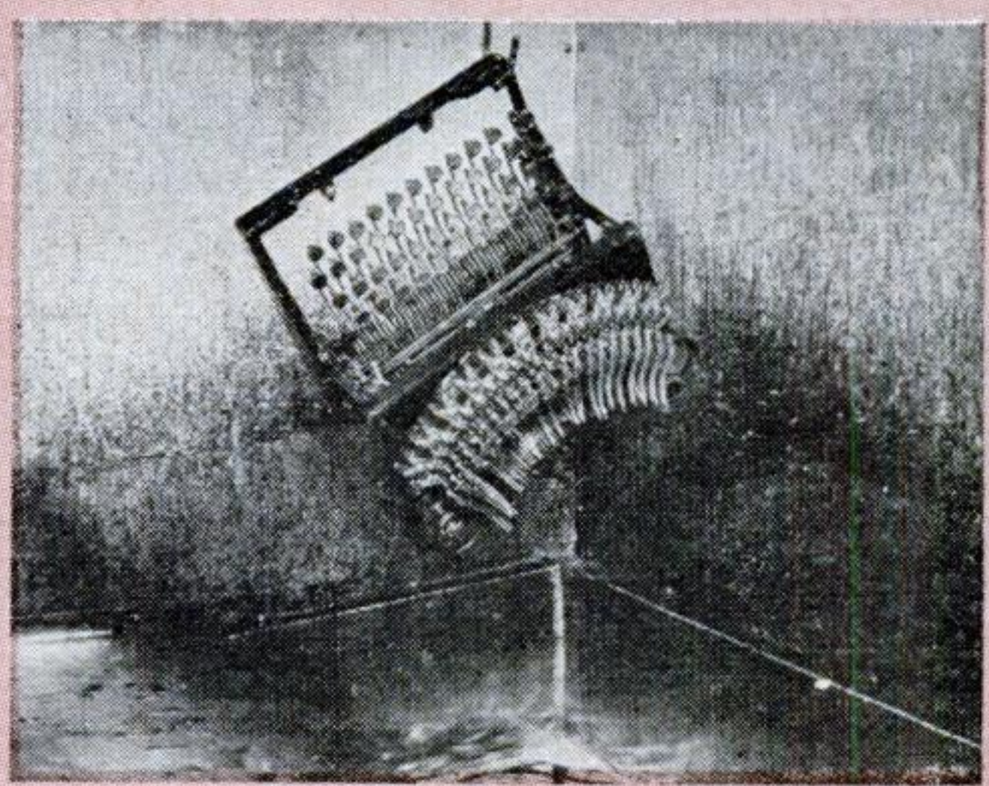
Typical of many typewriters brought in for overhauling, this stripped-down base is almost hidden by a coating of dust and grime. Some long-stored machines are vermin nests.



A few minutes later the same machine emerges from the bath and air-pressure treatment pictured below. Worn-out parts are then replaced and the typewriter reassembled.

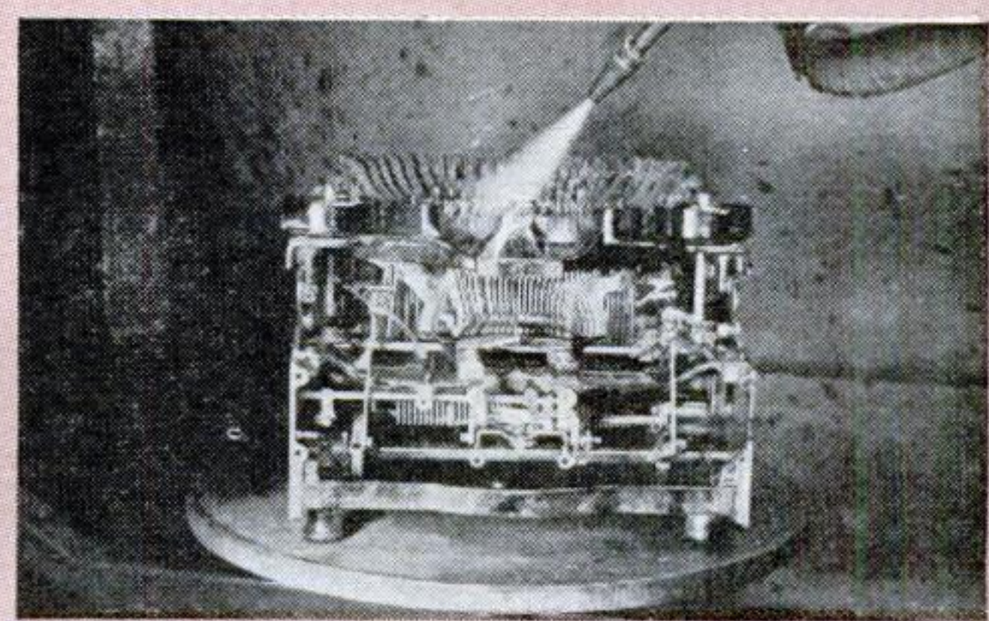


Air blowing under 150-lb. pressure dislodges all loose dirt. The covered tank on which the machine is standing contains a sodium cyanide bath for eating off rust if necessary.



Dunk is the word for this process. Placed in a tub containing special chemical solvents, the machine is left to soak clean. Usual time is 15 to 30 min. It's then hung up to drain.

The solvent is hosed off with scalding water. Compressed air is used again to blow out the water. By this time all but the most persistent grime has been washed or blown free.



Another cleaning compound, sprayed on under heavy air pressure, finishes the job. The turntable on which the machine rests is rotated to make every crevice accessible. END

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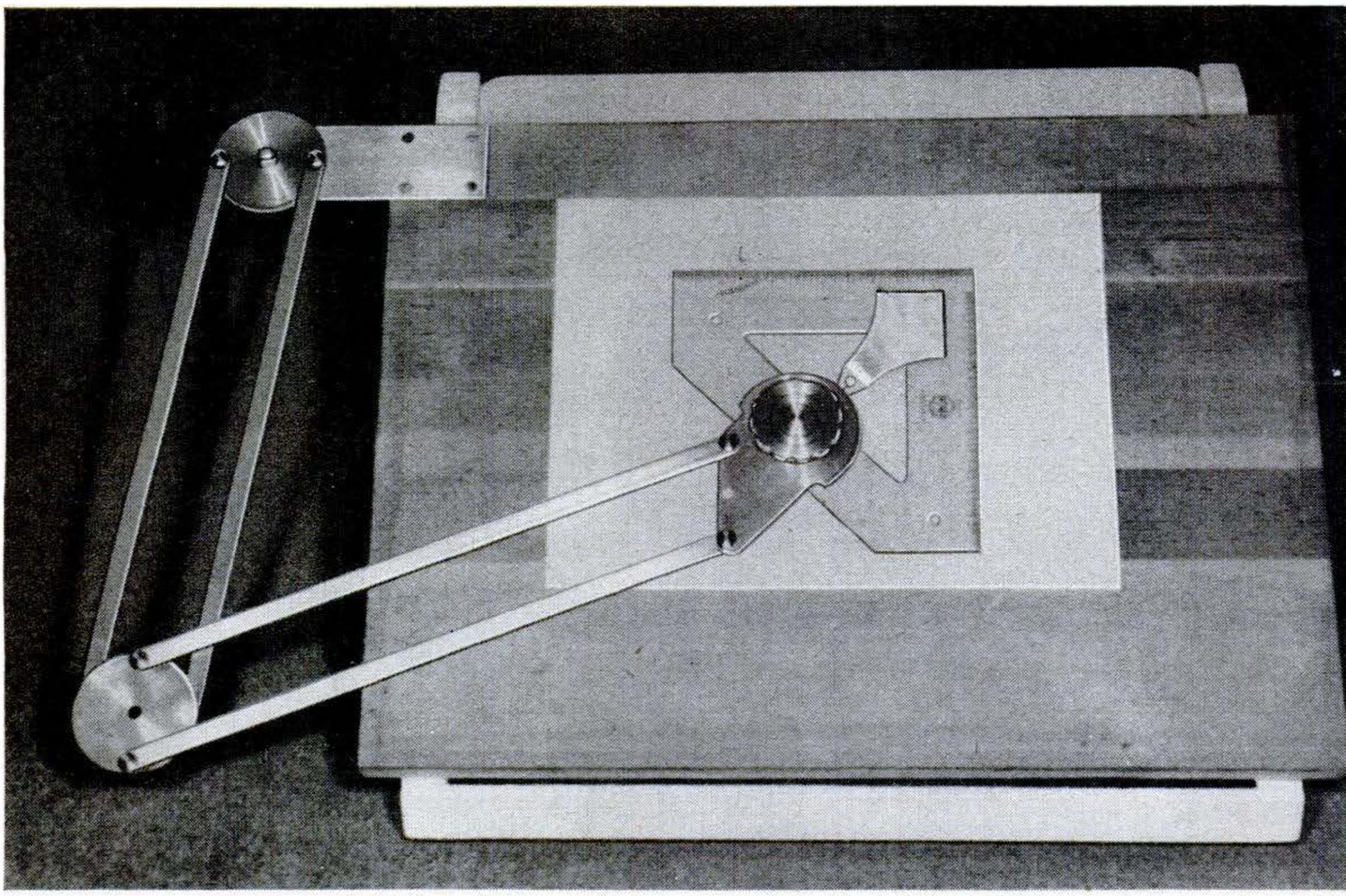

For professional work or drawings of home and shop projects, this is the machine for the task.

Throw Away Your T-Square

This drafting machine substitutes for a fistful of drawing instruments. You can build it without power tools, or use a lathe for a de luxe job.

By J. C. Magee

TIME spent on drawings can be cut 35 to 50 percent, and what's left is 90 percent fun with this drafting machine. Taking the place of T-square, triangles, protractor, and rules on most jobs, it never falls off the board and doesn't call for three left hands.

The arms, disks, bracket, and index plate are cut from 3/32″ dural sheet. As shown, the machine is made largely on a lathe with a jig used to precisely locate and drill the holes. However, a reasonably accurate machine can be built without power tools.

After laying out the holes on one arm, clamp all four together and drill them. For the disks, clamp sheet stock to the faceplate, drill and ream the center hole, and part out to 2⅜″ diameter. To make the jig, a guide block was mounted ⅜″ below faceplate center and a locating block mounted about 3″ off center. One outside hole was drilled with the jig against the locating block. Then 1″ and 2″ gauge blocks were used to spot the center and other .125″ hole. The jig then was used for drilling the disks and head.

Dowel pins inserted in the first set of holes, a surface plate, and a square were used to locate the jig for drilling the other two holes in one disk. Arms and disks are

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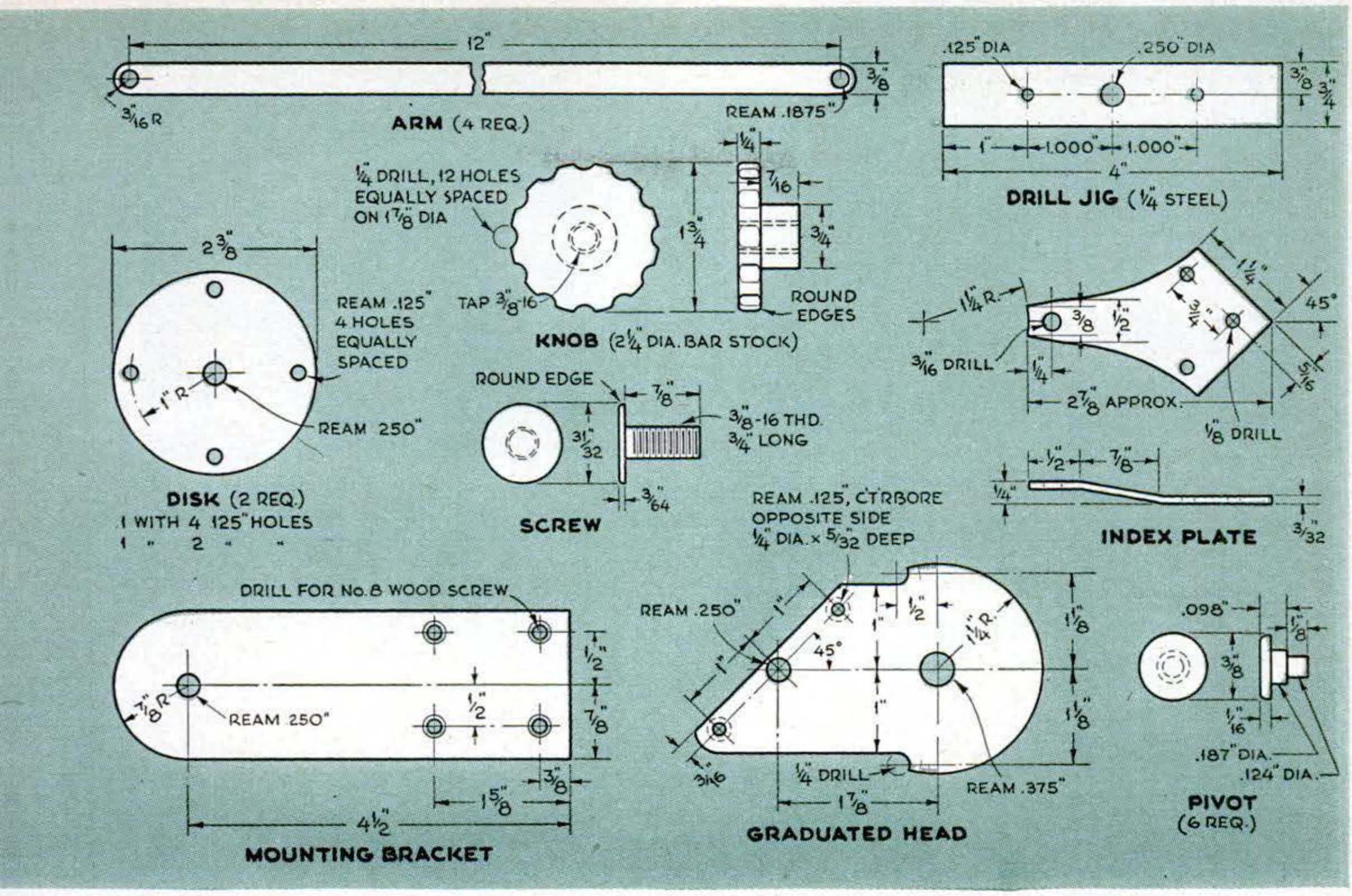
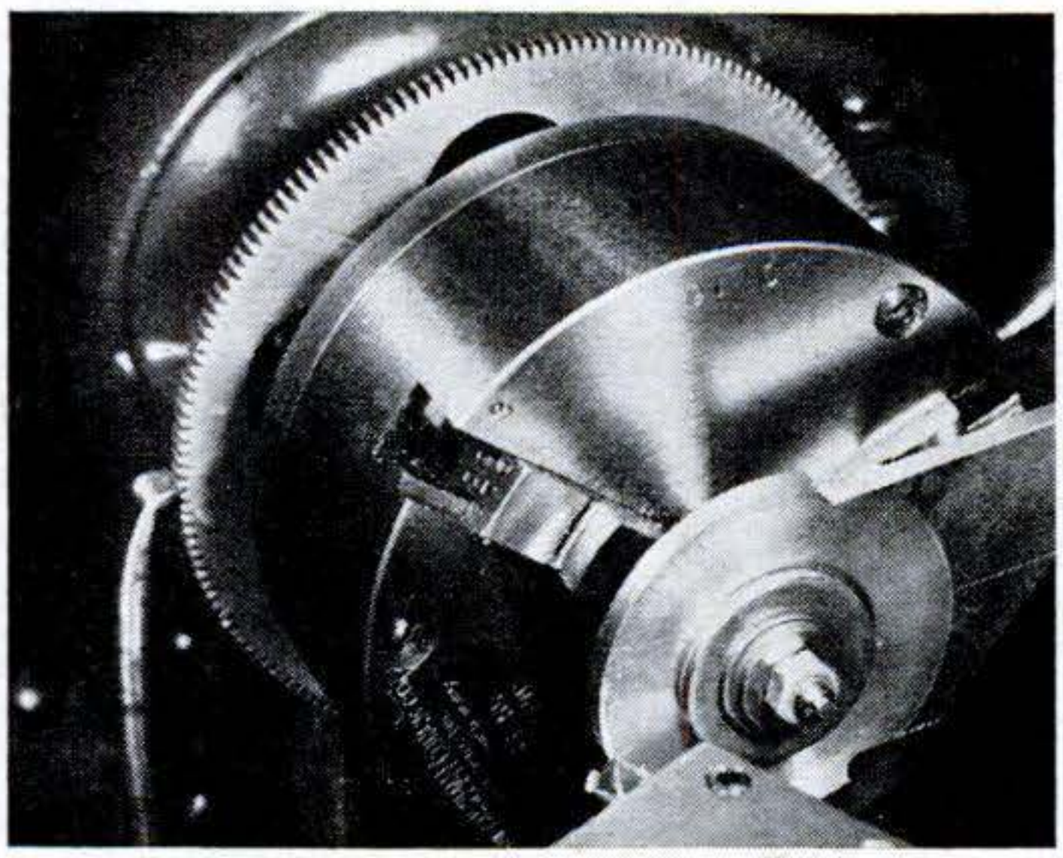


Don't let the decimal-point dimensions scare you, since they're not critical in a hand-tool job.

joined by the pivot pins. The head was graduated by mounting a 180-tooth gear behind it in the lathe, and the scale by means of the compound rest as shown in a photo.

If you don't own a lathe, drill press, or gauge blocks, you can get by with careful workmanship and ingenuity. Instead of turning pivots, get some common ⅛" solid or hollow rivets and, by trial on scrap stock, find a drill that makes a hole that's a close push fit for them. Use square pieces instead of disks. Omit center holes in them and the .250" hole in the head. They are for the jig only.

With a good square, lay out two lines exactly 90 deg. apart on one plate. Prick-punch the intersection and swing dividers set at 1" radius to mark the four pivot holes,



Since lathe had no indexing attachment, a 180-tooth gear was mounted behind chuck to graduate head. Threading tool made the lines.

Gauge blocks were used to locate the holes accurately in the drill jig. Above, a 1" block is used to spot the .250" locating hole.

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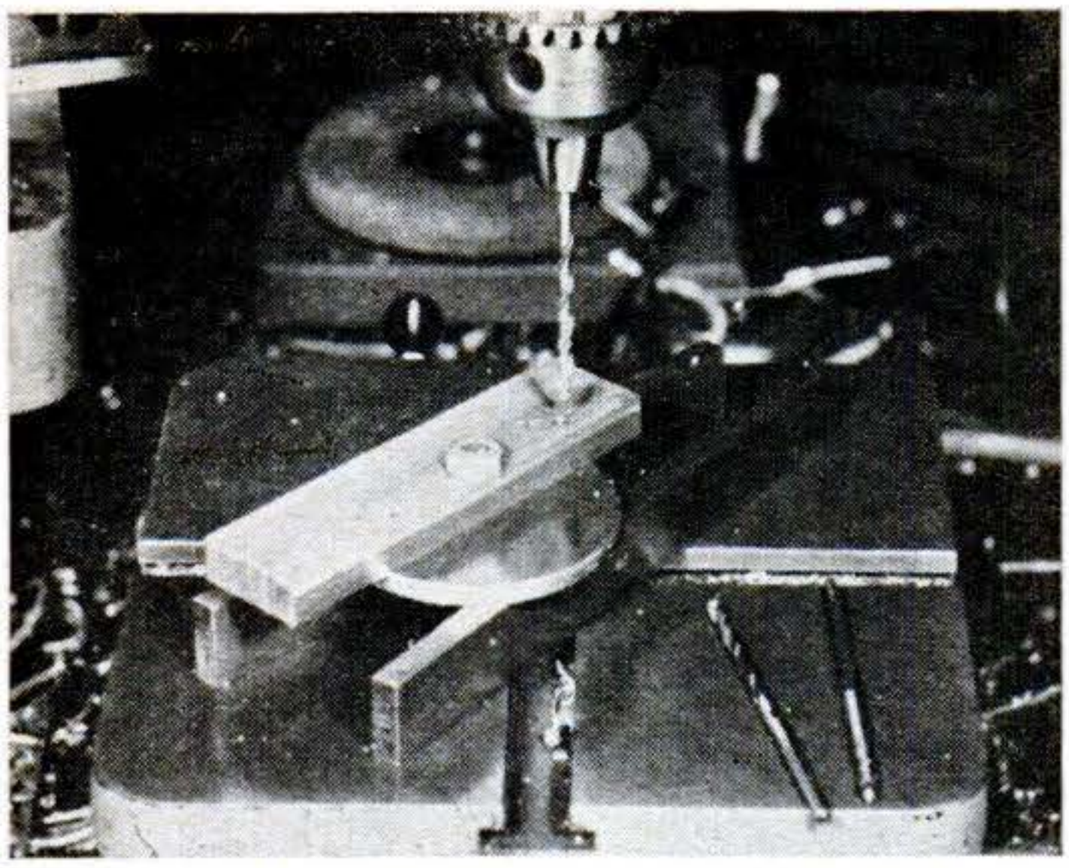
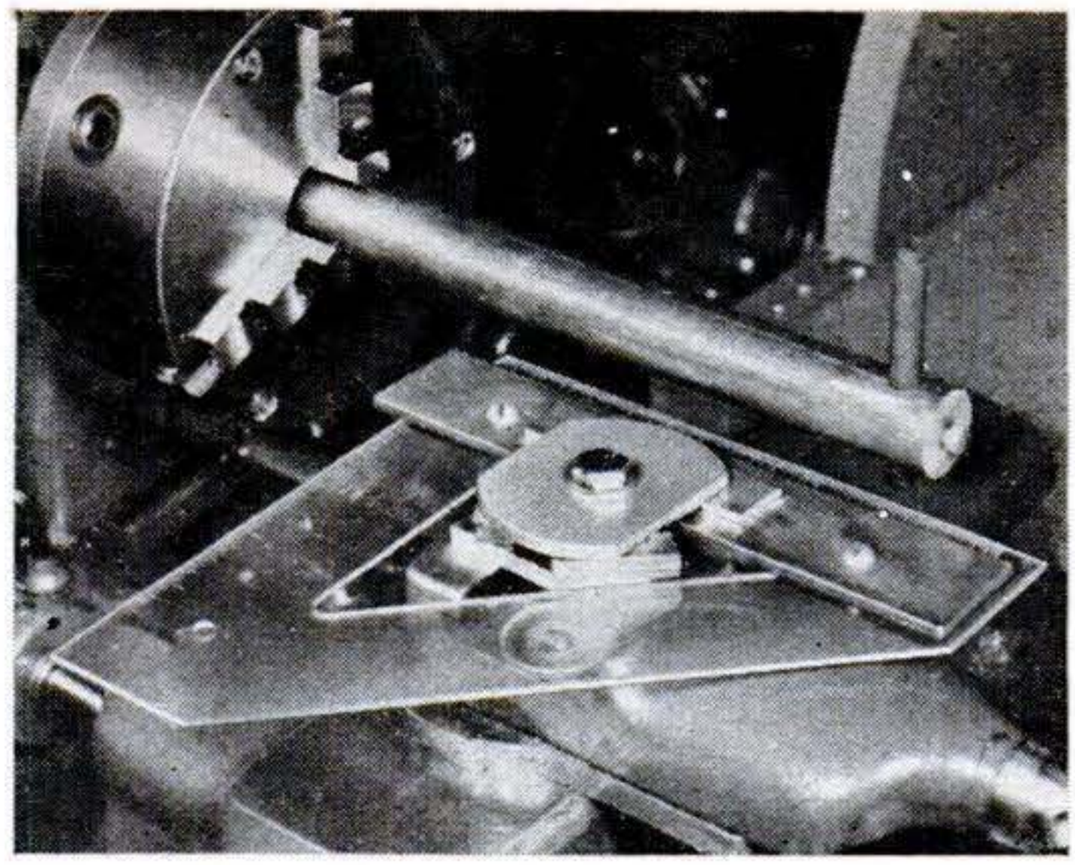


Jig is used on drill press to make holes in disks and head. Here a ¼" screw holds disk to jig while the .125" holes are drilled.

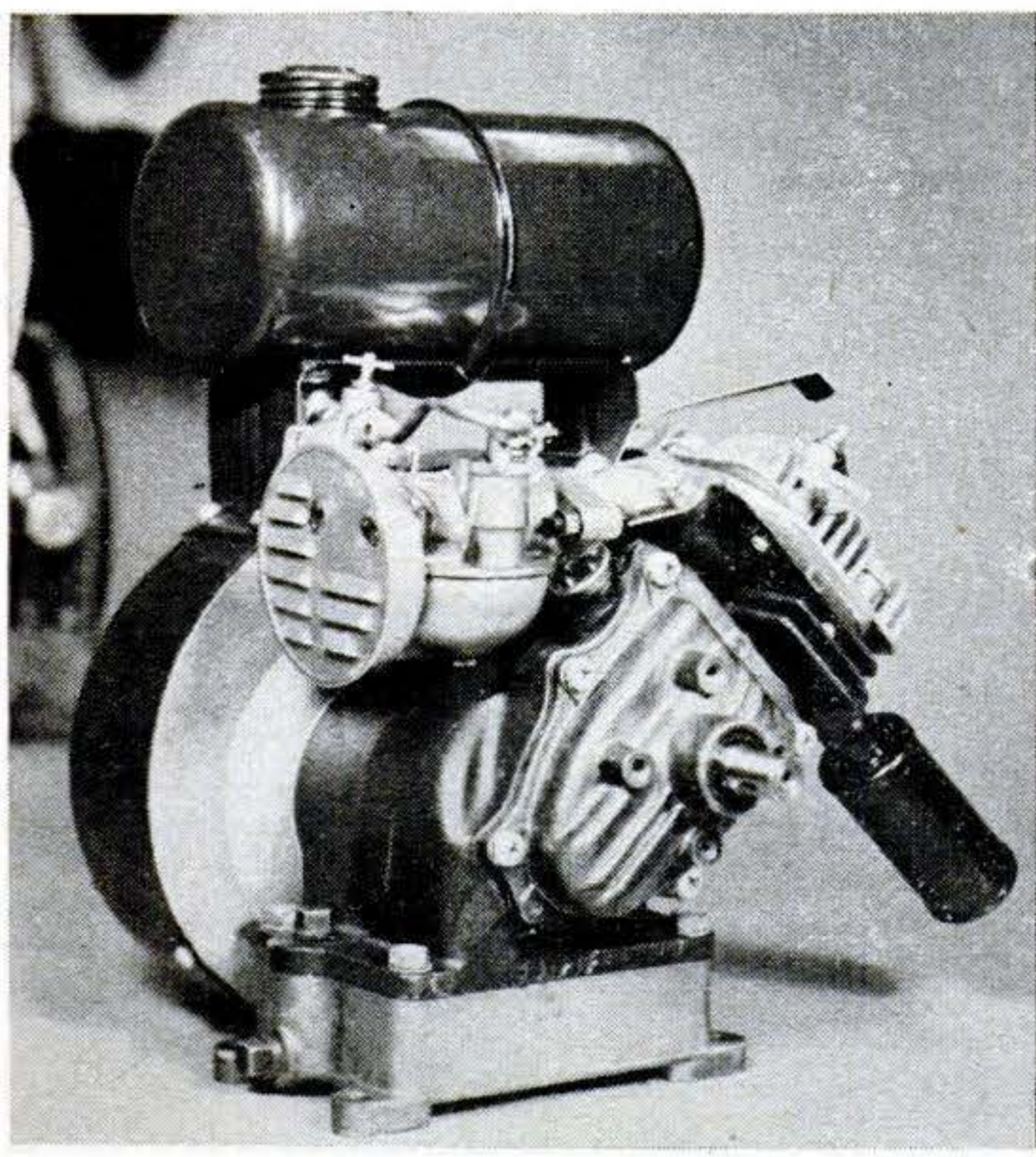


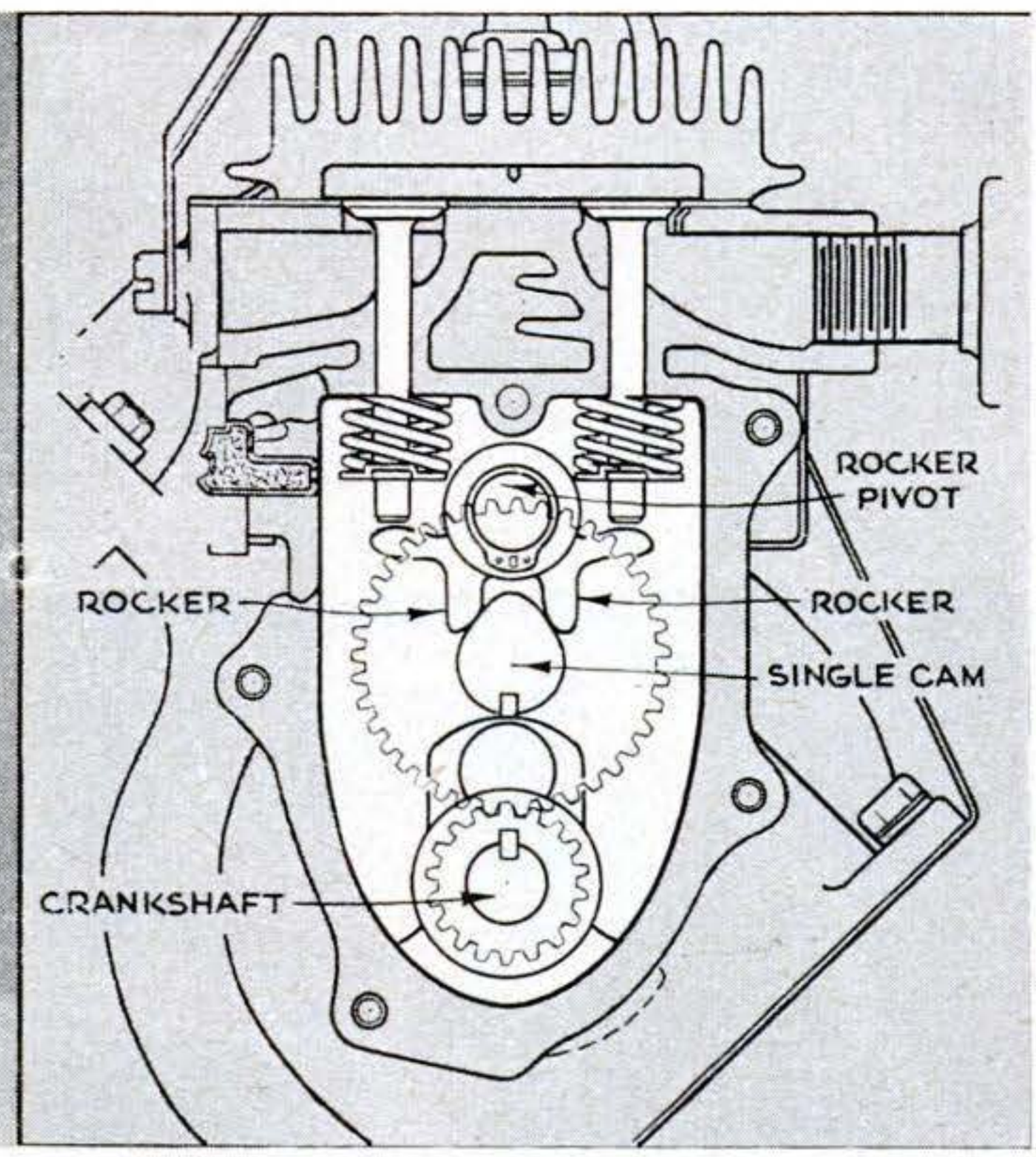
When the triangle was graduated, it was bolted between two steel strips for support. Assembly was clamped to compound slide rest.

and carefully prick-punch the hole locations. Clamp together the two squares and the head and drill two opposite holes right through. Separate the parts and drill the other two pivot holes in the square on which they were laid out.

Countersink the holes a bit so the rivets can be filed flush after peening over. Mount the upper pivot plate tightly on the mounting bracket by one or more bolts. The top disk in the photo was attached by a ¼" bolt through the center hole. It doesn't turn but is solidly clamped. Cement a cardboard or plastic protractor to the head and suitable scales to the triangle. A radio knob can be used instead of the turned knob. END

Camshaft Is Power Take-Off of Four-Cycle Engine





THIS one-cylinder air-cooled engine for power mowers has a built-in 2-to-1-speed reduction, since it uses the camshaft as the power take-off. Another unusual feature of this little four-cycle power plant, built by Reo Motors, Inc., of Lansing, Mich., is the single cam that operates both valves. As shown in the drawing above, the one cam actuates rockers for both intake and exhaust valves. The engine develops about 1½ hp. at 4,000 r.p.m. (2,000 r.p.m. at the output shaft). Weight is 31 lbs.

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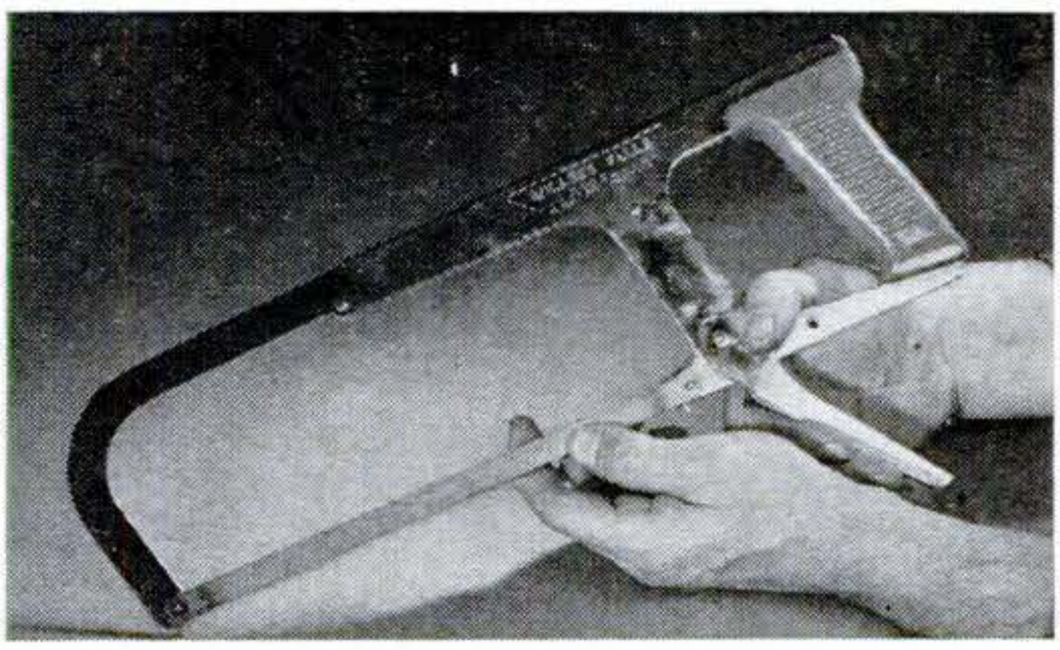
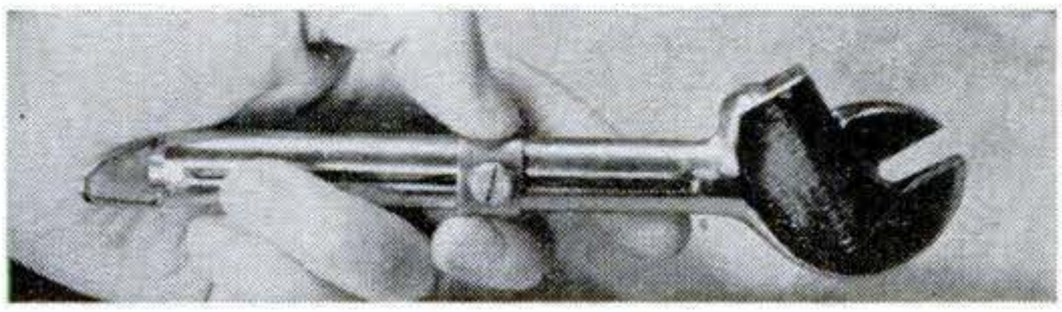
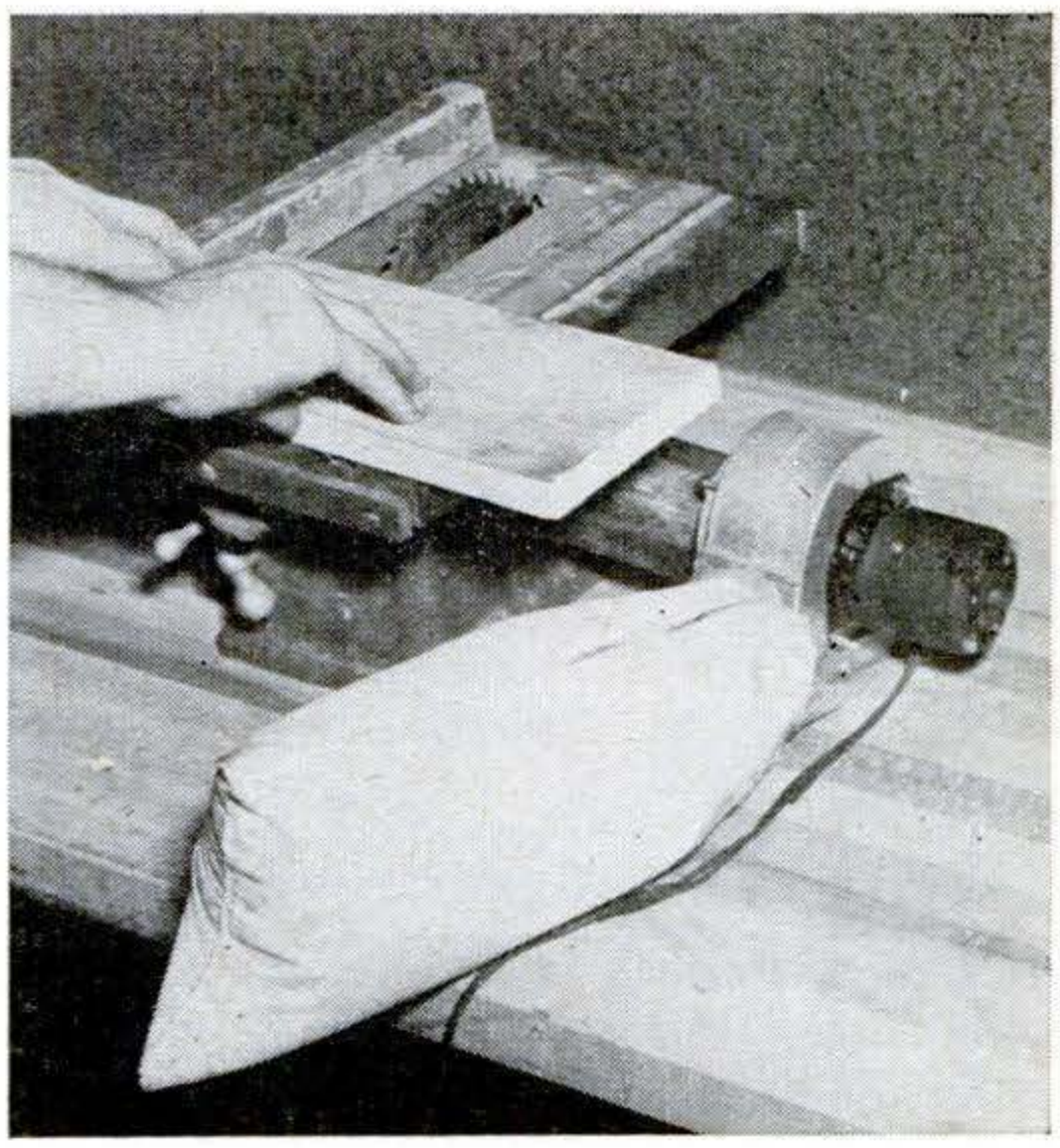
Tool Holds Abrasive Strips. Two jaws, tightened by turning a knob on the end of the handle, keep 1″ abrasive strips secure in this finishing tool. It's a product of Master Specialty Co., Inc., Minneapolis, Minn., and sells for about $1.



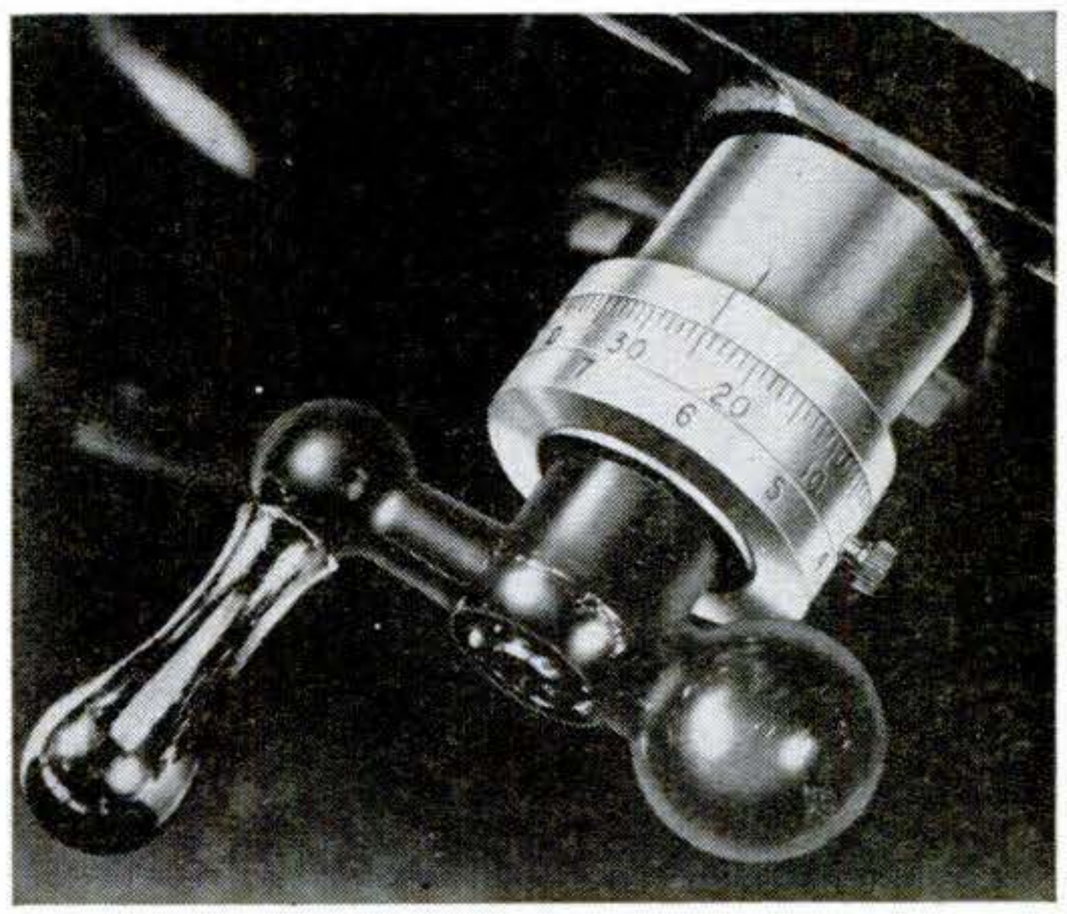
Lever Tightens Blade. In a new hacksaw frame introduced by the Millers Falls Company, Greenfield, Mass., there are no wing nuts to tighten when you change the blade. By means of a cam, the proper tension is applied to the blade when you snap up a lever that hugs the bottom of the handle. The frame is priced at about $3.50.



One Hand Adjusts Wrench. You can adjust this wrench quickly to any size up to 15/16″ even with work gloves on. Adjustments are made by sliding a thumb ring back and forth along the handle. Once set, the jaw stays put. The Trebor Machinery Co., of Milwaukee, Wis., makes the wrench. It retails for about $3.60.



Bag Collects Shop Dust. A motor-driven impeller in this new shop accessory sucks dust, shavings, and chips into a collecting bag while you work. Called a Dust-O-Vac®, it can be used with a circular saw, bandsaw, or jigsaw, a grinder, sander, shaper planer, wood lathe, and other tools. Universal Yonkers Corp., Yonkers, N. Y., includes with each device diagrams showing how the collector can be attached to any tool.



Dial Speeds Machine Work. Here's a dial that helps you get accurate cutting-tool adjustment or precise table movement on machine tools employing screw-feed travel. Made by Van Dyke Instruments, Inc., Glendale, Calif., it consists of two inter-geared dials. The first reads in thousands of an inch. The second reads in tenths and keeps track of the revolutions of the first. It takes shafts from ¼″ to 11/16″.

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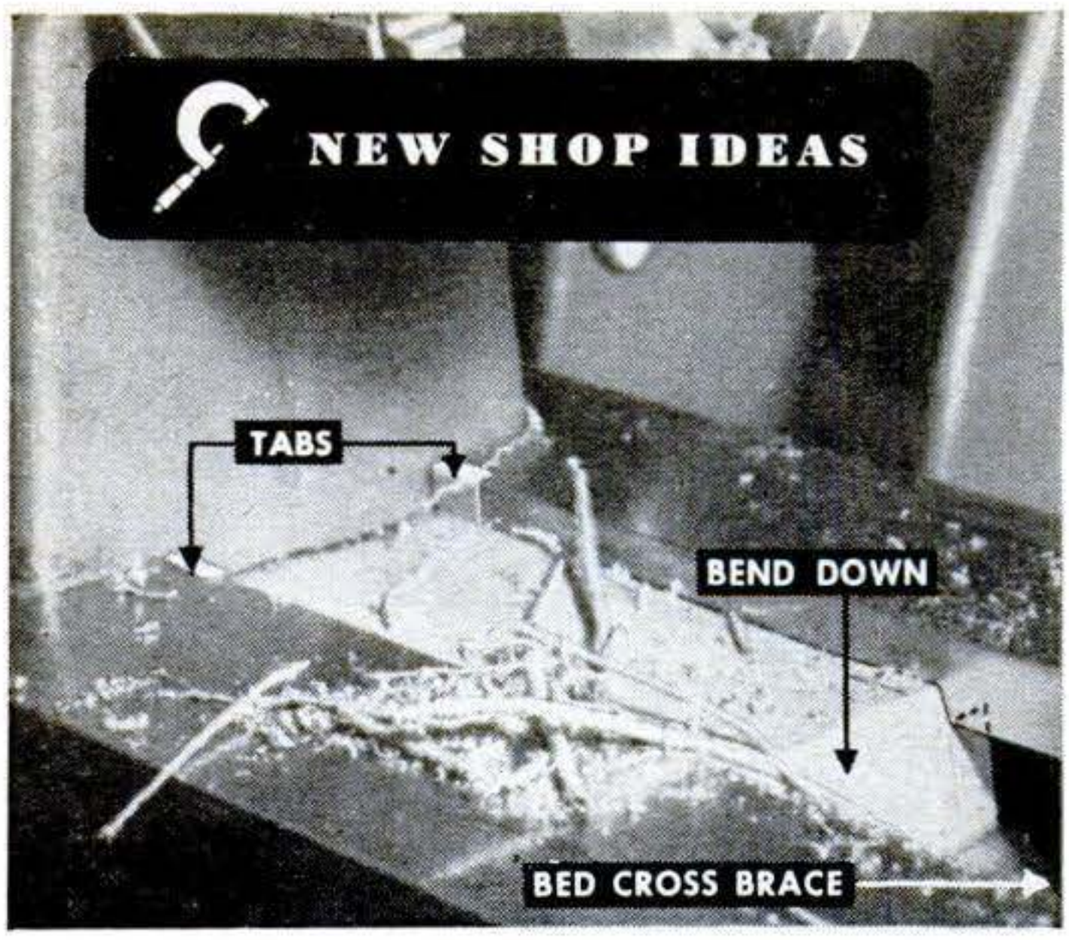
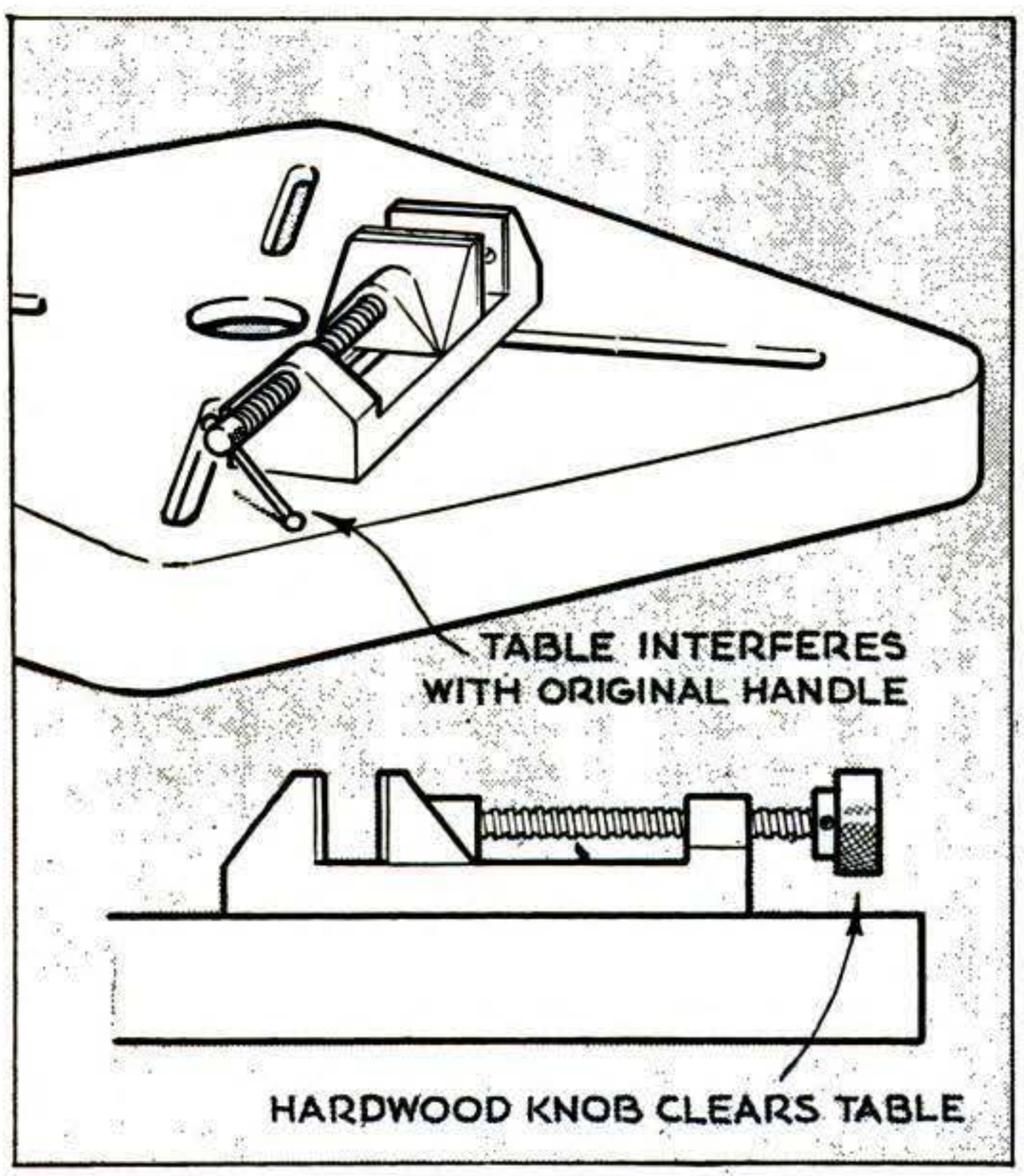
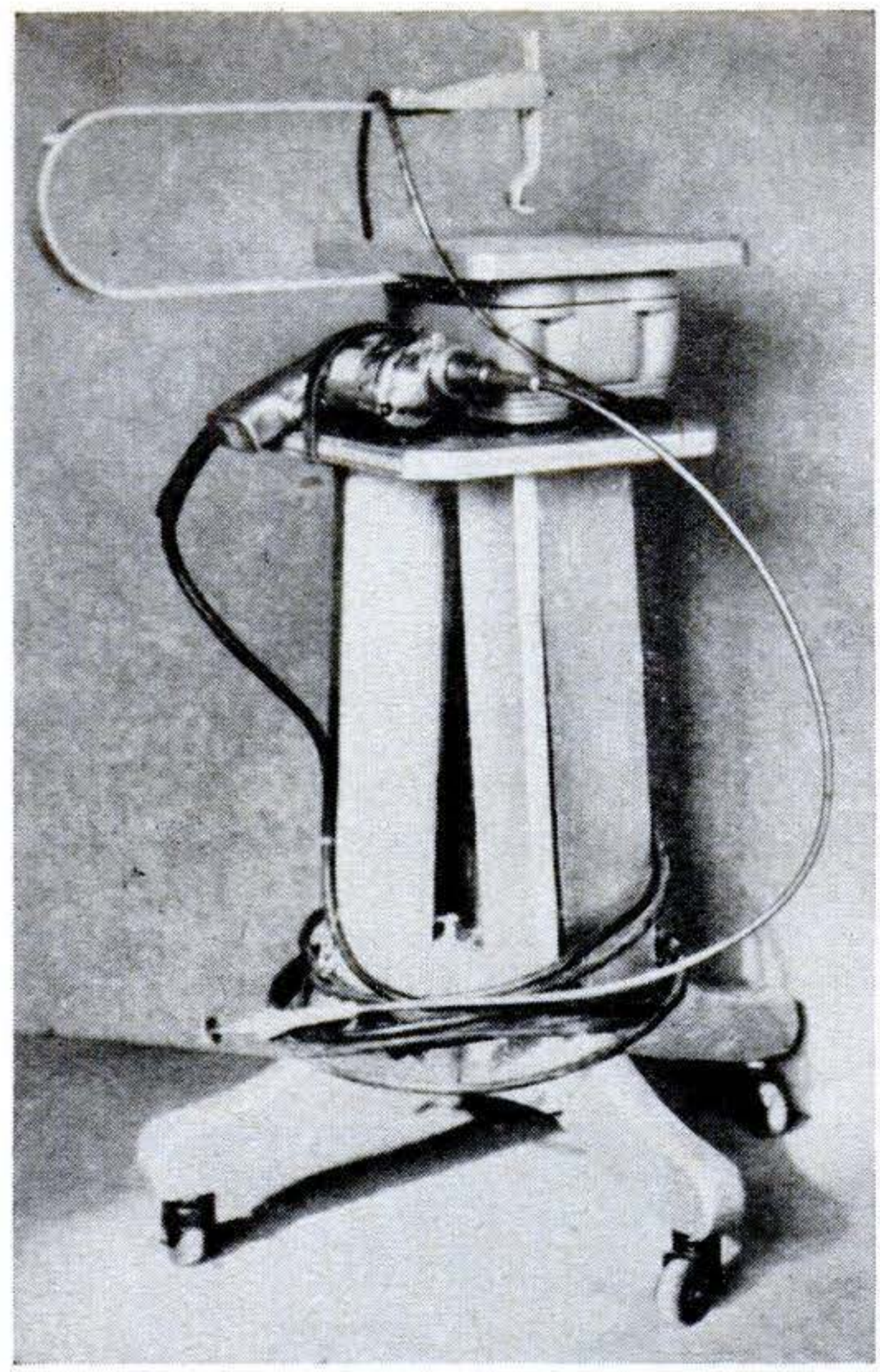


Shield Stops Chips. It's hard to clean under the headstock of many bench lathes, and the space there soon fills with metal and plastic chips, mixed with cutting and lubricating oils. A sheet-metal shield between the ways, held on with small tabs, will keep chips where you can readily brush them away.—*John M. Avery, Dexter, N. Y.*

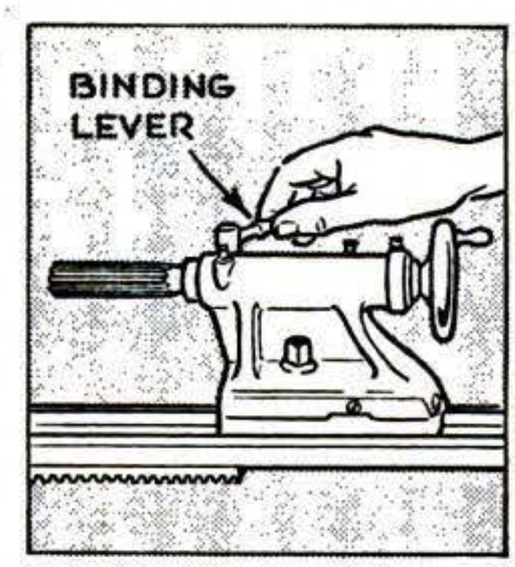


Knob Improves Vise. Annoyed by the way the conventional handle on my drill-press vise struck the table whenever it was adjusted, I cut off the handle and substituted a round knob turned from maple. The knob was drilled a tight fit for the screw shank and cross-drilled for a securing pin. Incidentally, I've found that maple can be knurled beautifully in the lathe at light pressure.—*H. R. Pfister, Bronx, N. Y.*



Chair Base Makes Stand. The base from a discarded swivel chair and a few pieces of scrap pine got together to make this handy portable tool stand. We use it in a modelmaking shop to hold a light magnetic jigsaw and a drill-driven flexible shaft—two tools in demand at different benches and therefore good to have easily movable. The four 1″ by 4″ by 20″ uprights are held to the base by wood screws, and the 12″ square top is secured with finishing nails driven down into the uprights.—*Walter Kateley, Cleveland.*

Stops Chatter. With many old lathes, looseness around the tailstock ram will cause chatter in reaming operations. Sometimes also a large drill in the tailstock will wander at the start of a hole. The remedy for both troubles, I find, is to tighten up a bit on the binding lever until you feel a little drag on the handwheel.—*John C. Martin, Kings Point, N. Y.*



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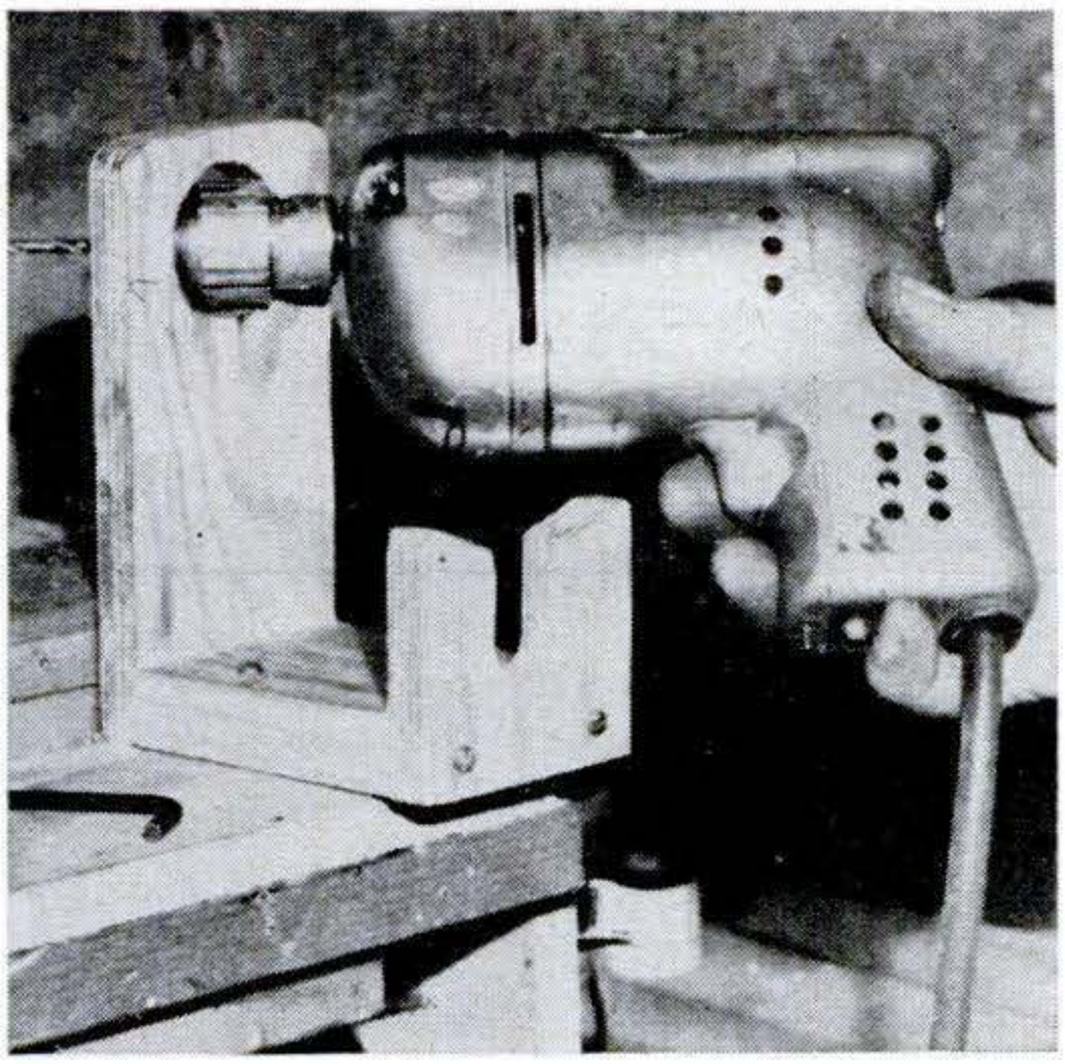
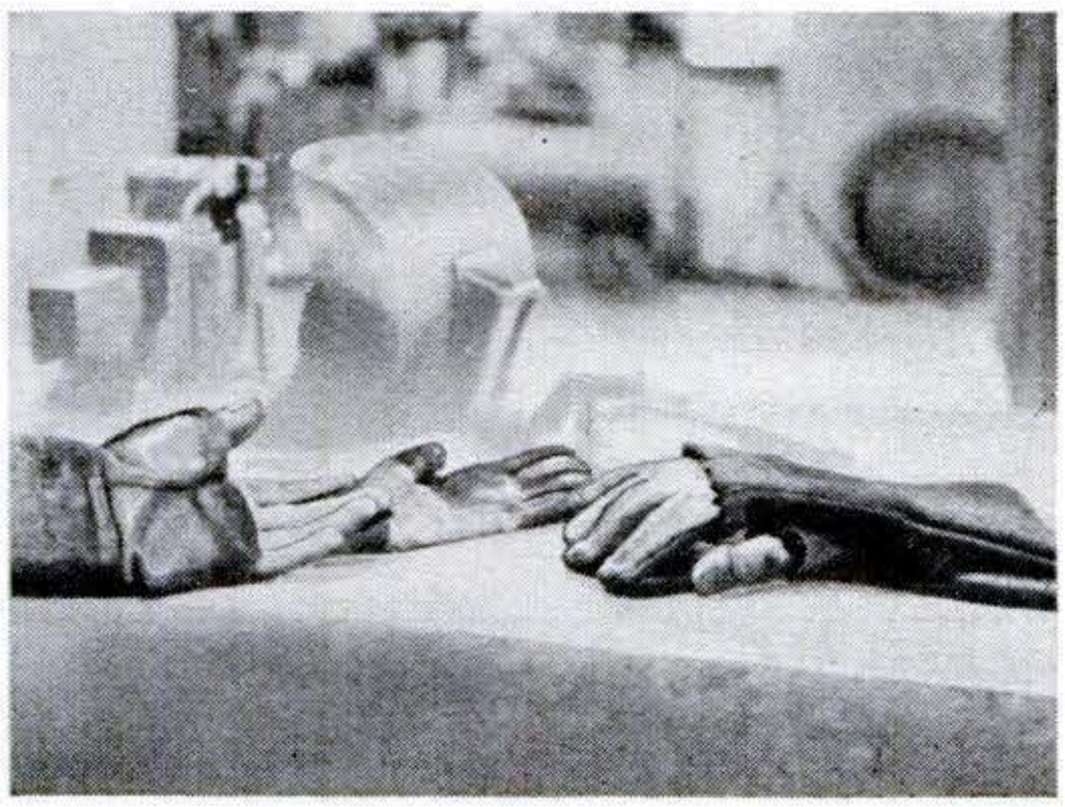
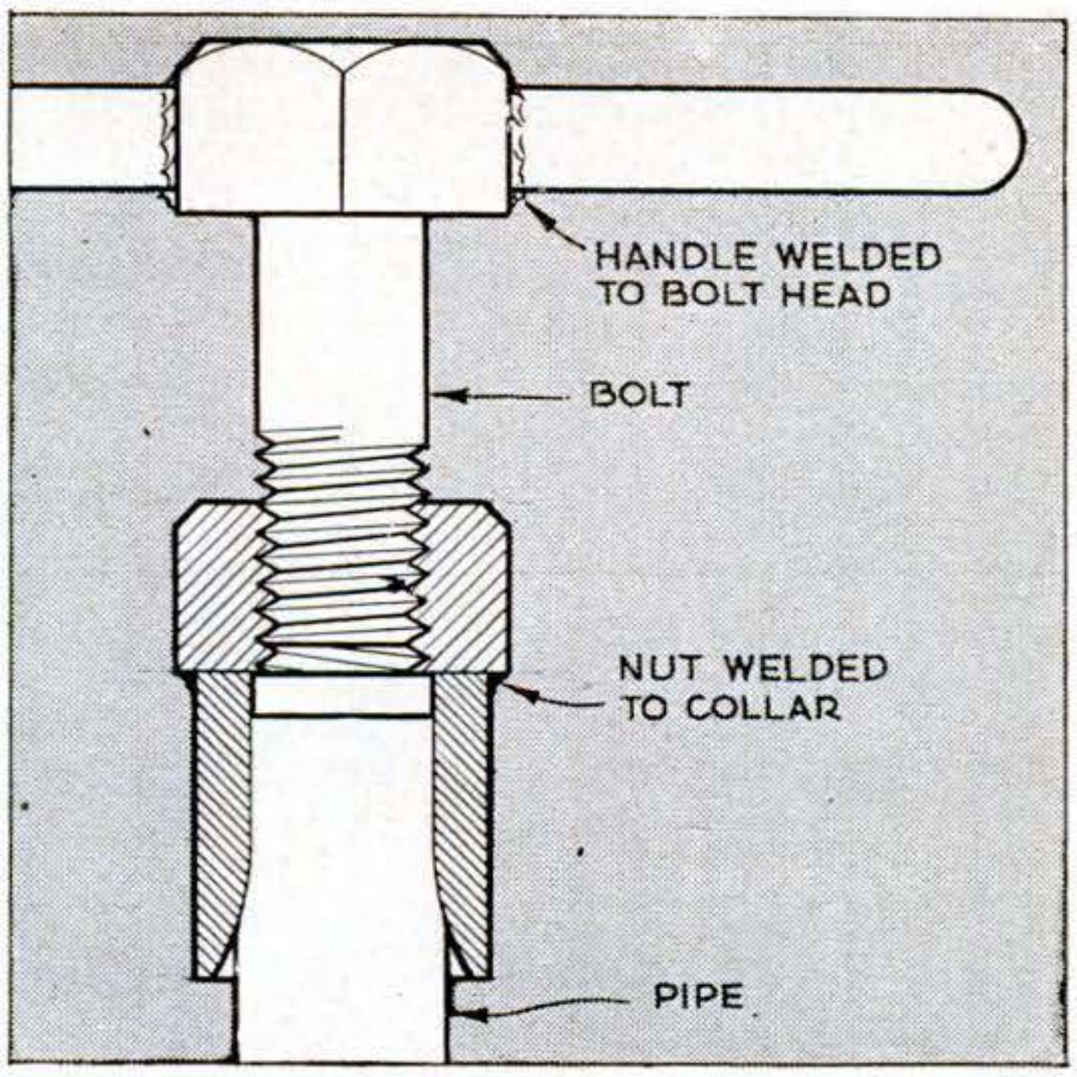


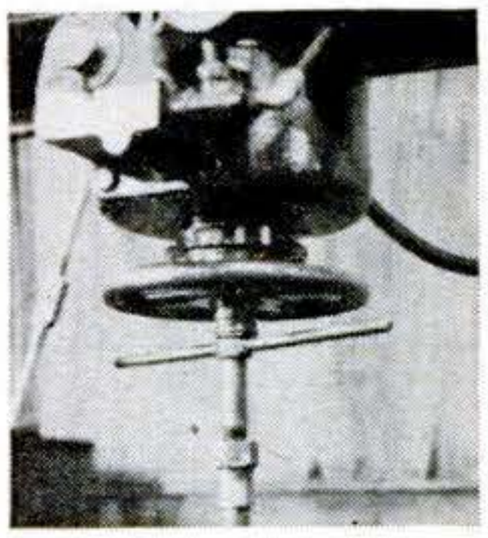
Rack Holds Drill. Although handy for many bench jobs, a small electric drill does not always get full use because it is awkward to stow away or get out. I made myself the simple plywood rack shown above, tailoring it to suit the shape of my drill, and screwing it down at a spot where it can be reached in an instant. A power outlet for the plug should of course be near-by.—*A. H. Smith, Hawthorne, N. Y.*

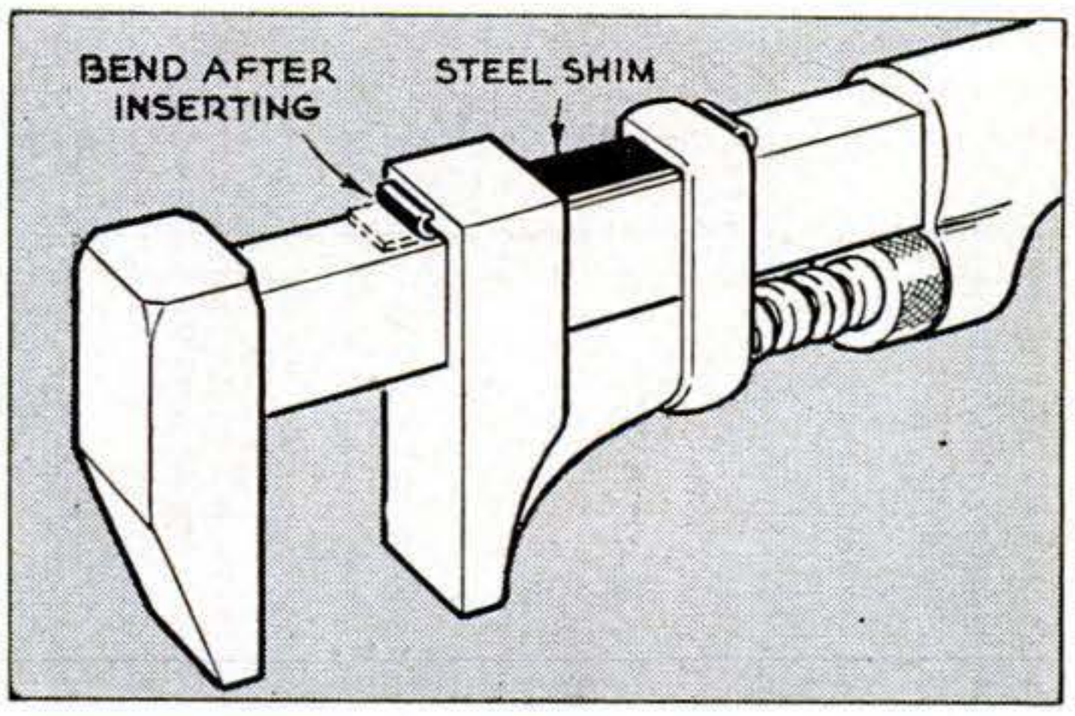


Low-Cost Welding Gloves. One welder, exasperated at the high price of all-leather gauntlet-type welding gloves, noted that they wore out at the fingers long before full wear had been had from the rest of them. He cut the fingers from a worn pair at the knuckles and inserted a pair of inexpensive leather-front, cloth-back work gloves. These cost him 69 cents a pair, compared to $3.50 for the all-leather ones. He reports that the inserted ones last about as long and can be replaced easily, and that the gauntlet parts seem to last indefinitely.



Collar Swages Pipe. In one machine-shop job it was necessary to thread the inside of the ends of some ¾″ pipe. However, the pipe quite often was found to have an oversize i.d., resulting in little or no thread. The fault was corrected by forcing a tapered swage or collar over the end of the cold pipe with an arbor press. A large nut was welded to the collar, and a bolt with welded handles removed the tool from the pipe when it had done its work.—*Paul F. Reents, El Monte, Calif.*





Shim Tightens Wrench. Worn monkey wrenches of the kind pictured above are difficult to set up tight against a nut because the jaws lose parallelism under pressure. For a semipermanent repair, bend up a roll on the end of some steel strapping, slip it under the back, and bend up the other end.—*Wallace Genthner, Troy, N. Y.*

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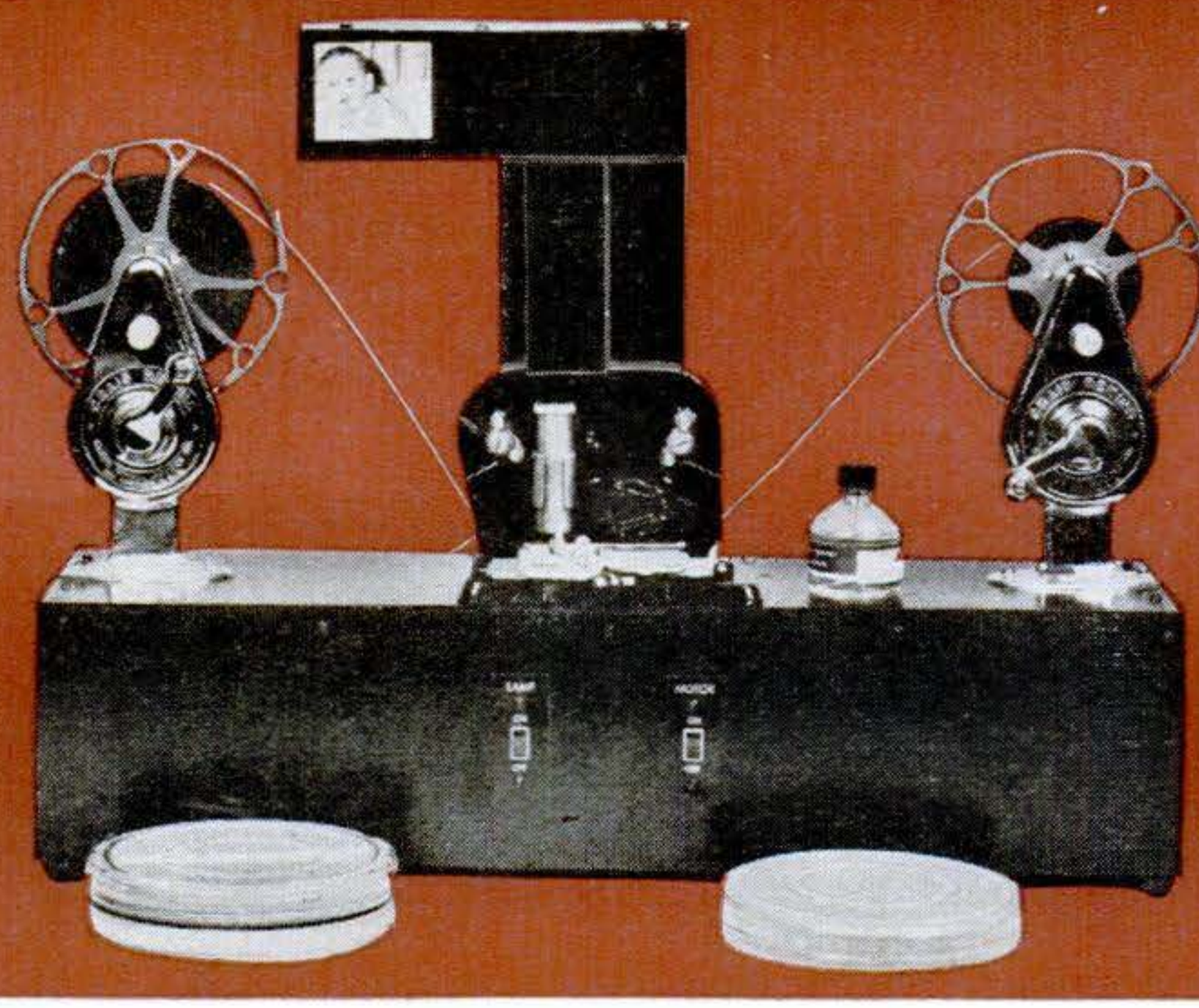
Action Editor Previews Home Movies



By Ray Heiskell

THERE are no two ways about it. If you take home movies, you've just got to have an editor to keep from boring your friends. Without it, you can show movies, but unless they're cut and arranged in effective sequence, there's apt to be no one around when your next show begins.

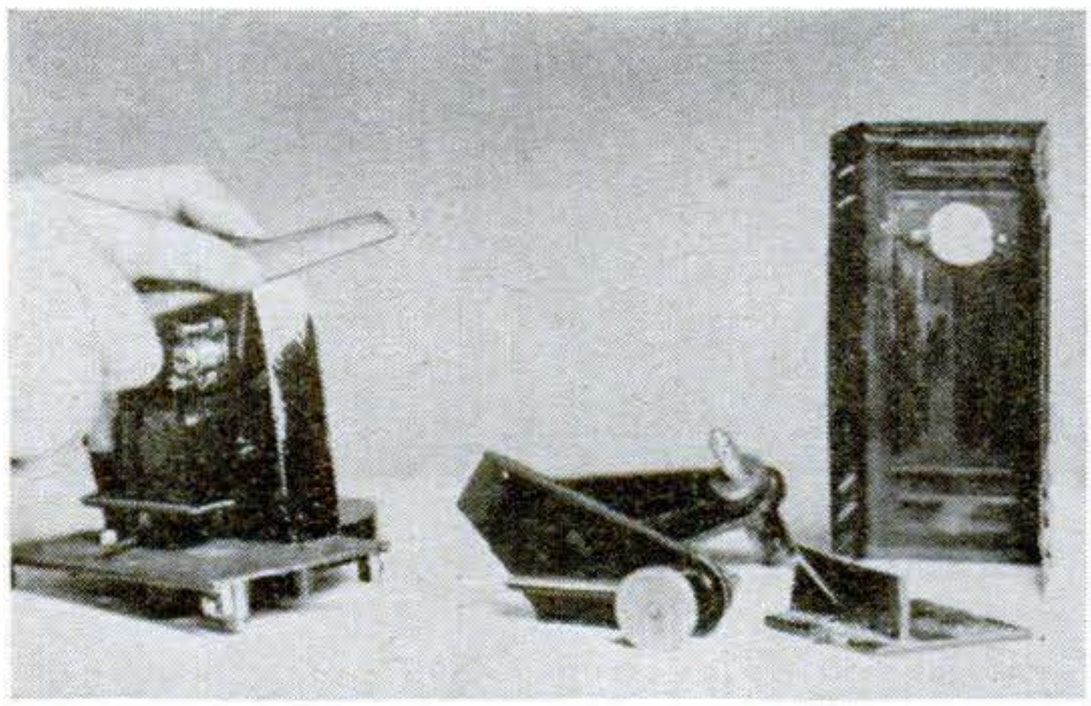
But what can you do? A good film editor costs almost as much as a good projector. If you've already strained your pocketbook to get a camera, projector, and other necessary odds and ends, an editor may seem exactly like that last straw on the camel's back.

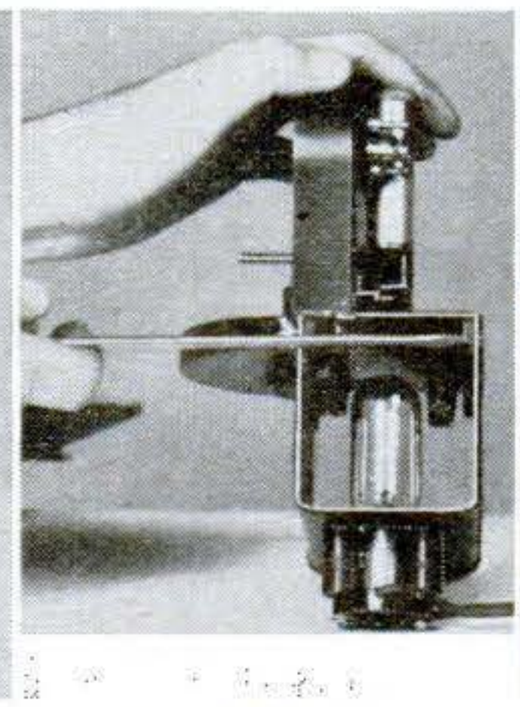
However, there's hope. On these pages you can take a look at my action editor. It does an excellent job. It enables me to see the action just as it will appear on the regular projection screen. The editor cost me less than $15, including the rewinds and the splicer.

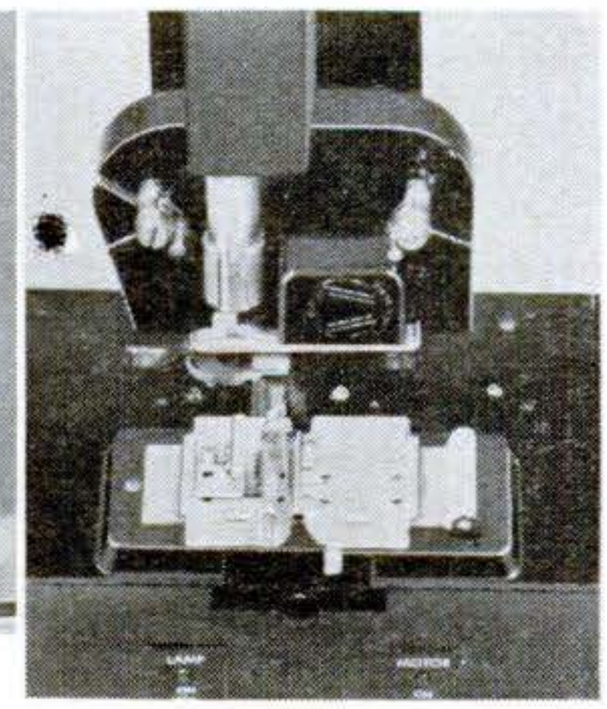
There's just one hitch. The starting point was an old projector that I'd discarded because I now have a new one. If you also have an old one, you're in real luck. If not, you may still find a bargain on the used photo-equipment counters.

The projector I used was a Univex, model P-8. But other makes could be adapted to the same purpose, with only minor changes from the procedure I followed.

Using a hacksaw where necessary, take the projector apart. The film gate, film-feed claws, gear train, lens, and motor are







Take the projector apart, removing parts that you won't need for the editor. Smooth any cut edges with a file. Do not disturb the operation of the gear train that gives the intermittent action. Since the lens will be used vertically in the editor, it's necessary to remount the projection bulb (center) so it will burn base down. Protect the film from overheating by locating a glass disk between the bulb and lens. A drawer was installed in the splicer (right) to catch film cuttings. This simplifies clean-up operations. The film sprockets were discarded.

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the main parts you need. If the projector is pretty badly worn, as mine was, it may be necessary to rebush the bearings and smooth some of the shafts.

Remove the fire screen and lamp socket from the lamp housing. Then hacksaw off a section of the housing directly behind the film aperture and lens. Cut a ¾″ hole in the housing directly beneath the film aperture and mount the socket in the hole.

When the editor is in use, this will allow the lamp to burn base down. The bulb is not being used efficiently, but it must burn base down or the filament will sag and burn out. I use a 100-watt projection bulb. A larger one can be used, but this is not recommended unless provision is made for forced-draft cooling. I find that a 100-watt bulb gives all the intensity needed.

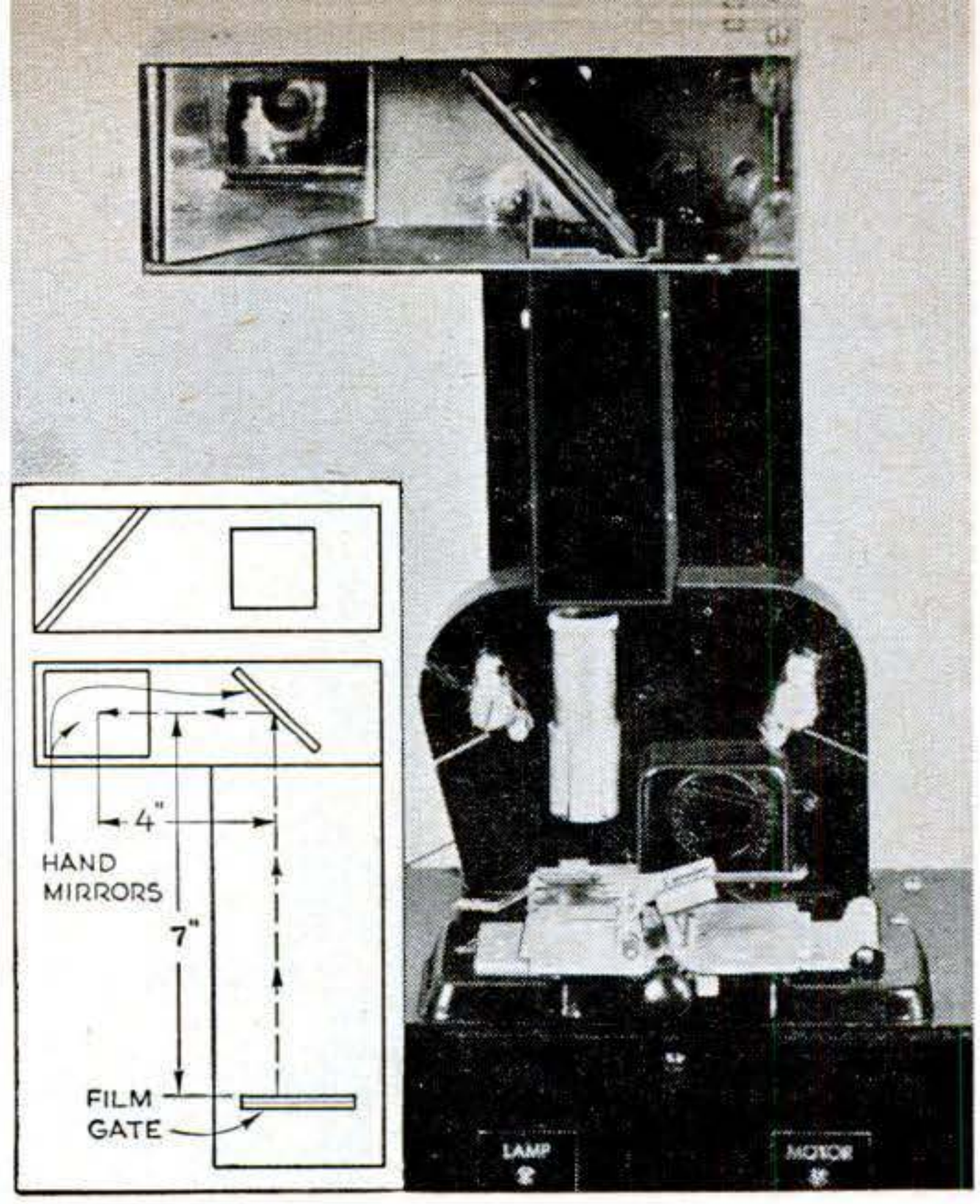
The 4½″ by 6″ by 20″ base can be built from plywood, using ¾″ quarter round in the corners. If you want to use 400′ reels, you'll probably find it best to increase the base length about 4″. The mechanism is mounted inside the back panel with machine screws, but the top must be cut out at the back edge to accommodate the shape of the mechanism. Make a circular cut-out in the top panel between the lamp and lens and insert a glass disk ¼″ thick to keep the film from overheating.

The housing for the mirrors was made of sheet metal, assembled with machine screws and solder. The construction could be simplified by using plywood. The image is projected up a rectangular tunnel, 1½″ by 2″ in cross section. The upper, horizontal part measures 2¼″ by 2½″ by 7″, and the back supporting panel is 3½″ by 10″. This panel is screwed to the back of the gear-train housing.

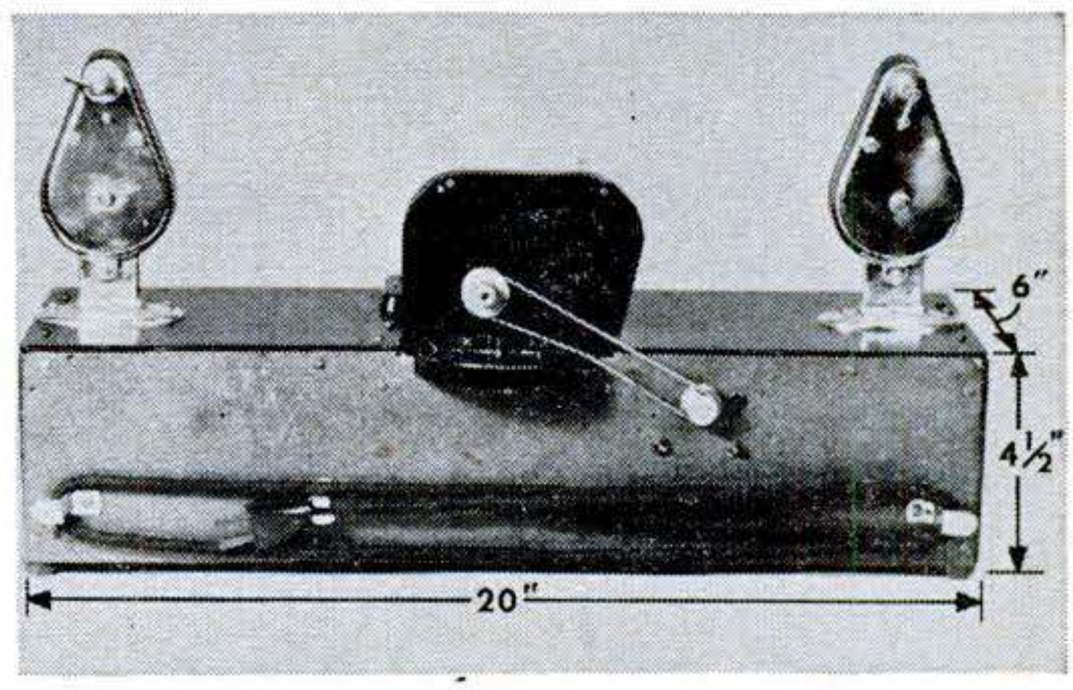
An accompanying diagram shows the layout of the optical system. You view the image on a piece of ground glass mounted in front of the second mirror.

Switches were taken from the control panel of the projector, the panel being cut to retain the lettering. These were then mounted on the editor base.

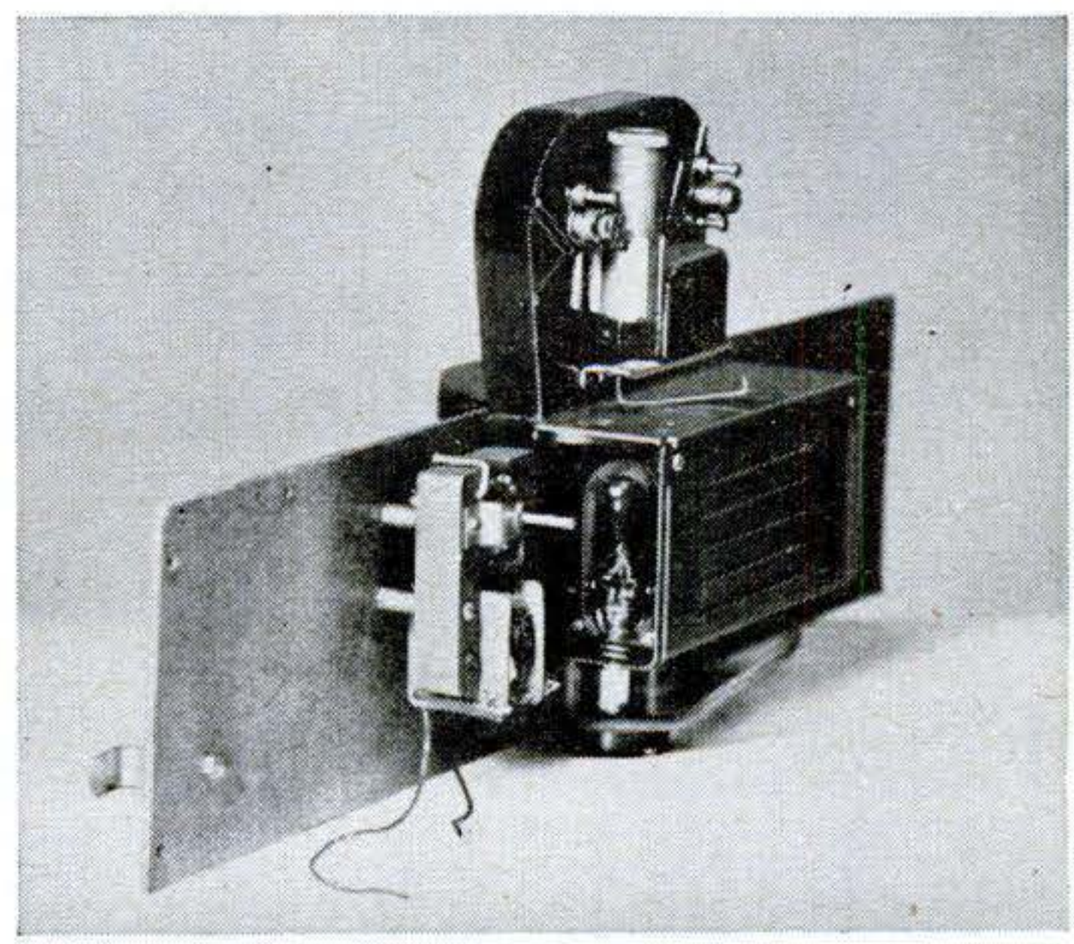
It will be noted in one of the photos that the splicer has a drawer in its base. I added this to catch the film cuttings. The film sprockets were not used because of the difficulty of removing the film for splicing. The film is run directly from the supply reel to the film gate, then to the takeup reel. Slack is taken up by the rewinds as the film is fed.



Two hand mirrors serve as the optical system. Located at the distances shown in the diagram, these give a projected image about 1⅜″ by 1⅞″. The top drawing shows a plan view.



A belt from projector drives the intermittent gear train. Two clips installed on the back of box are convenient for winding electric cord.



Entire mechanism is mounted to the back panel of base. Use machine screws inserted from the outside. The motor is seen in foreground.

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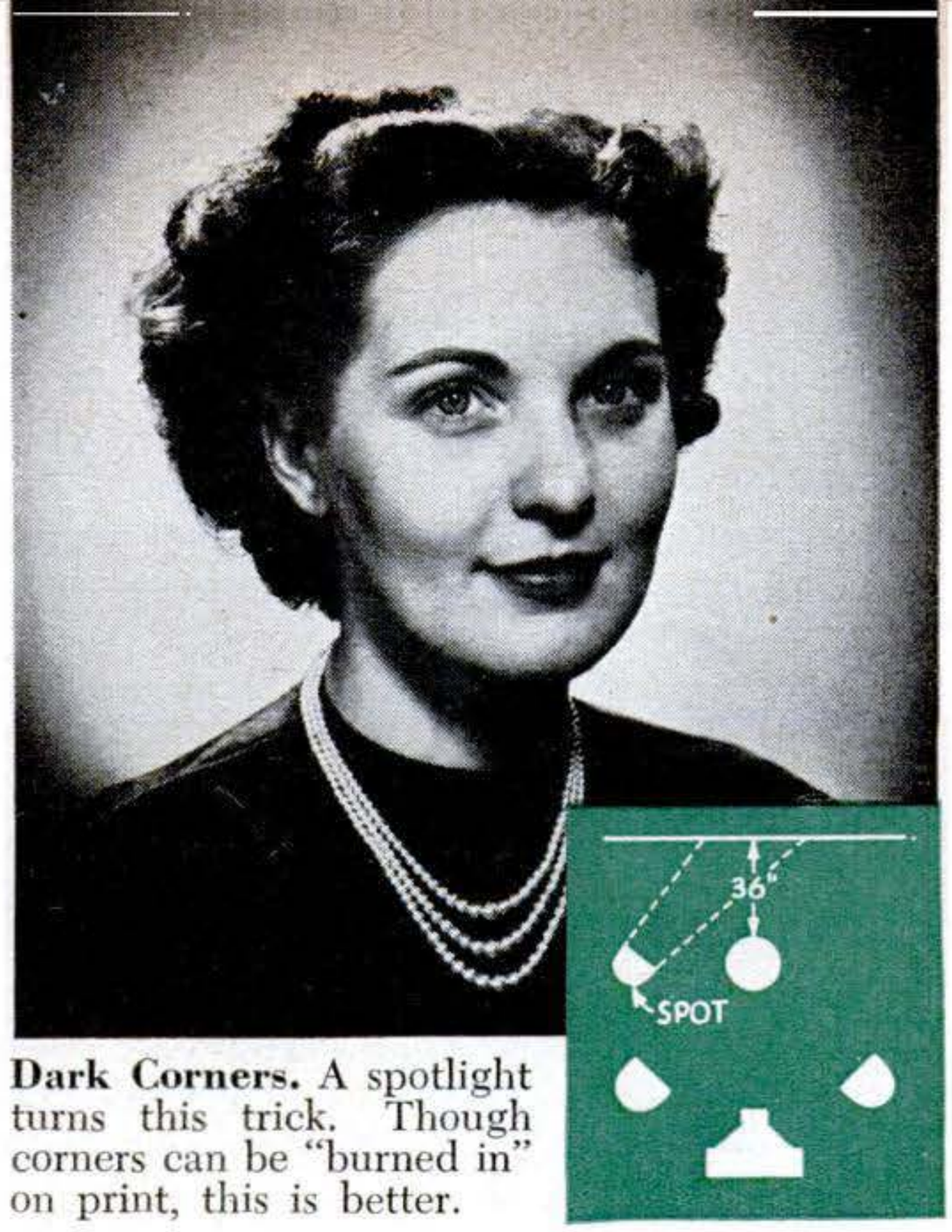
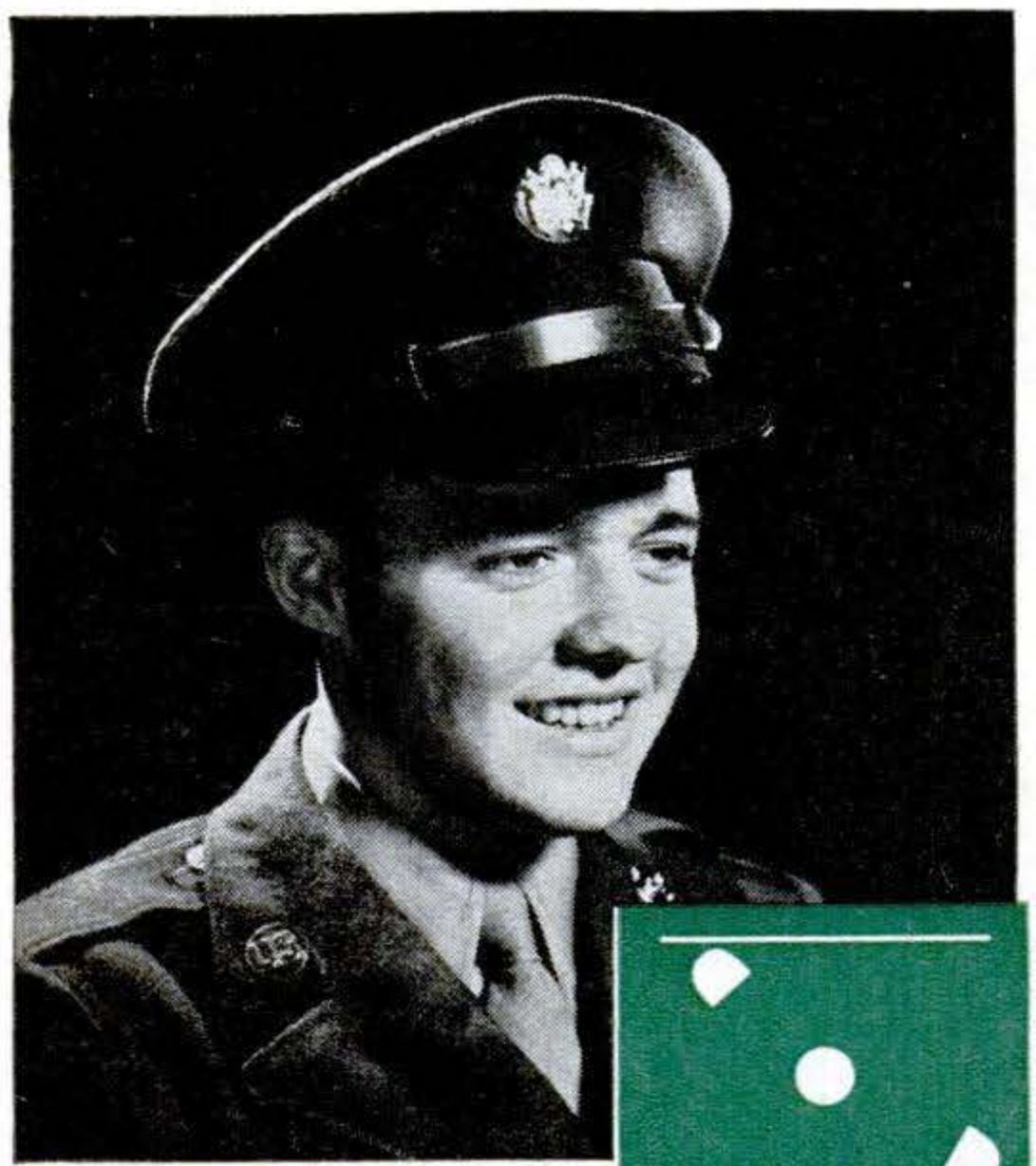
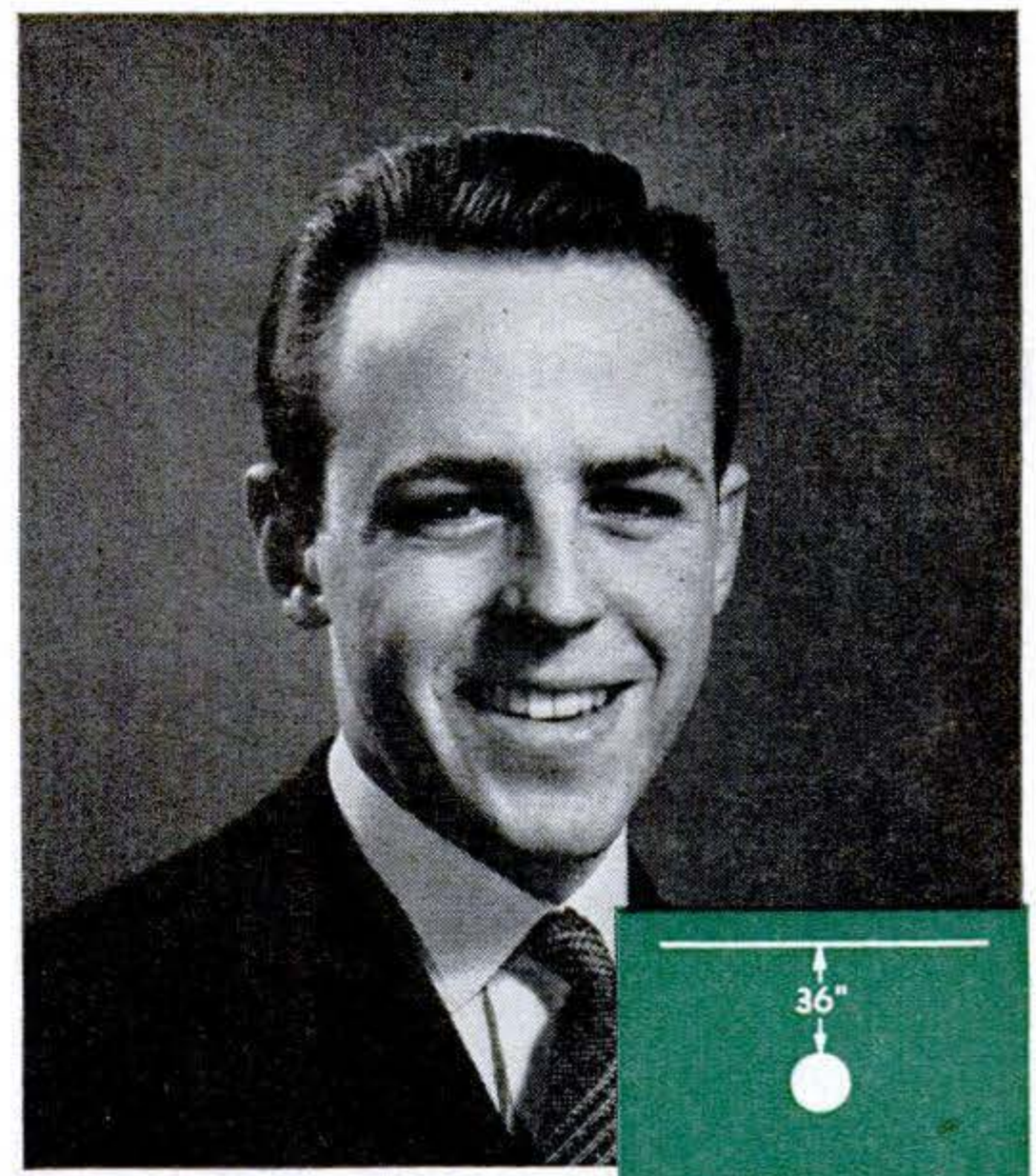
Light Background. Key to this effect is a floodlight. Direct it to cover more than picture area.



Dark Corners. A spotlight turns this trick. Though corners can be "burned in" on print, this is better.



Black Background. Outline the subject by using back and side lights without lighting background.



Gray Background. Use no background light. Vary background tone by moving sitter in or out.

Four Effects with One Background

FOR portraits, it's fine to have an assortment of backgrounds on hand. But they aren't necessary. With just a plain white wall or light window shade, you can give your photos backgrounds of varying tone.

To do this, you control the relative amount of light that falls on background and subject. You can even produce the effect of a black background with a white one.

In the examples at top of page, the flood and spot either can be located as shown or be hidden behind the sitter. Place front lights so shadows fall outside the picture area.—*Kenneth M. Swezey, Brooklyn, N. Y.*

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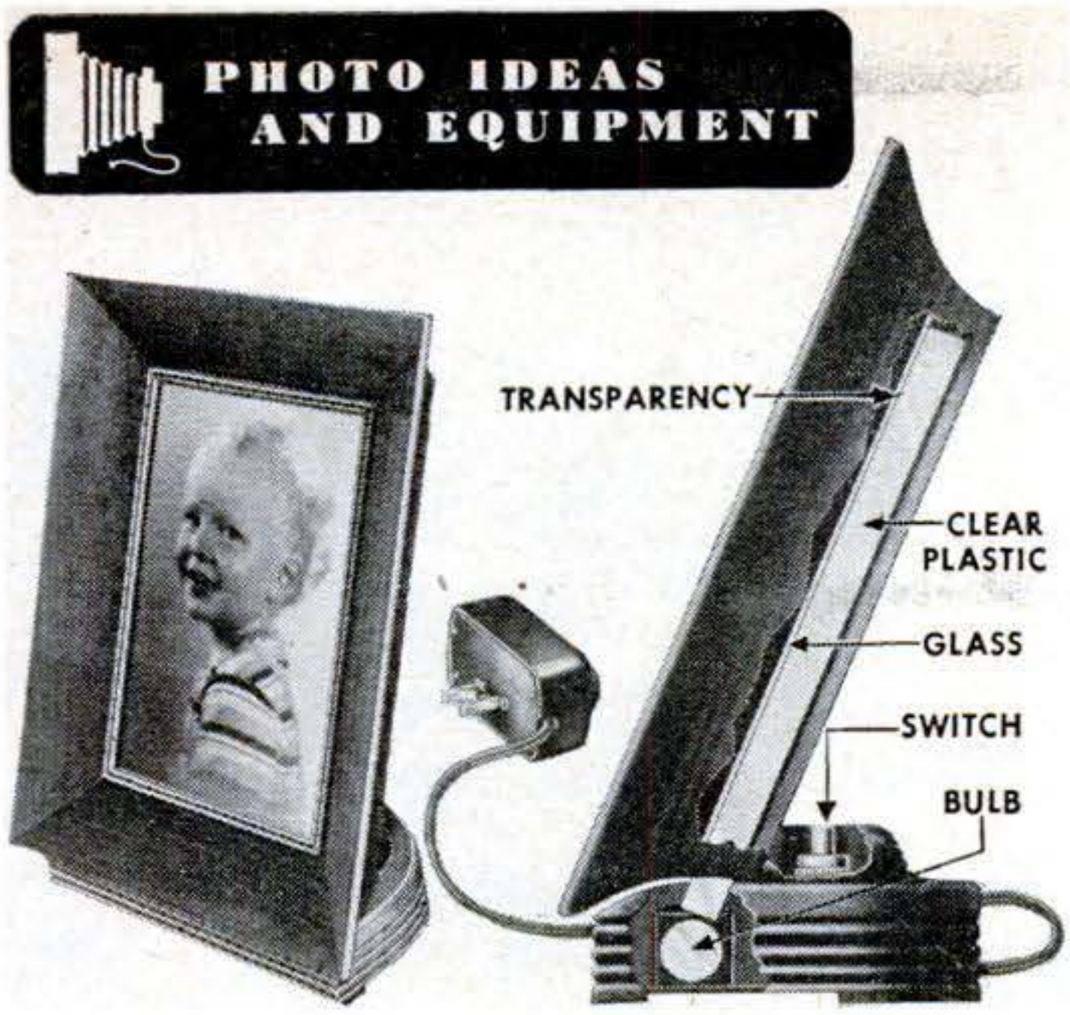
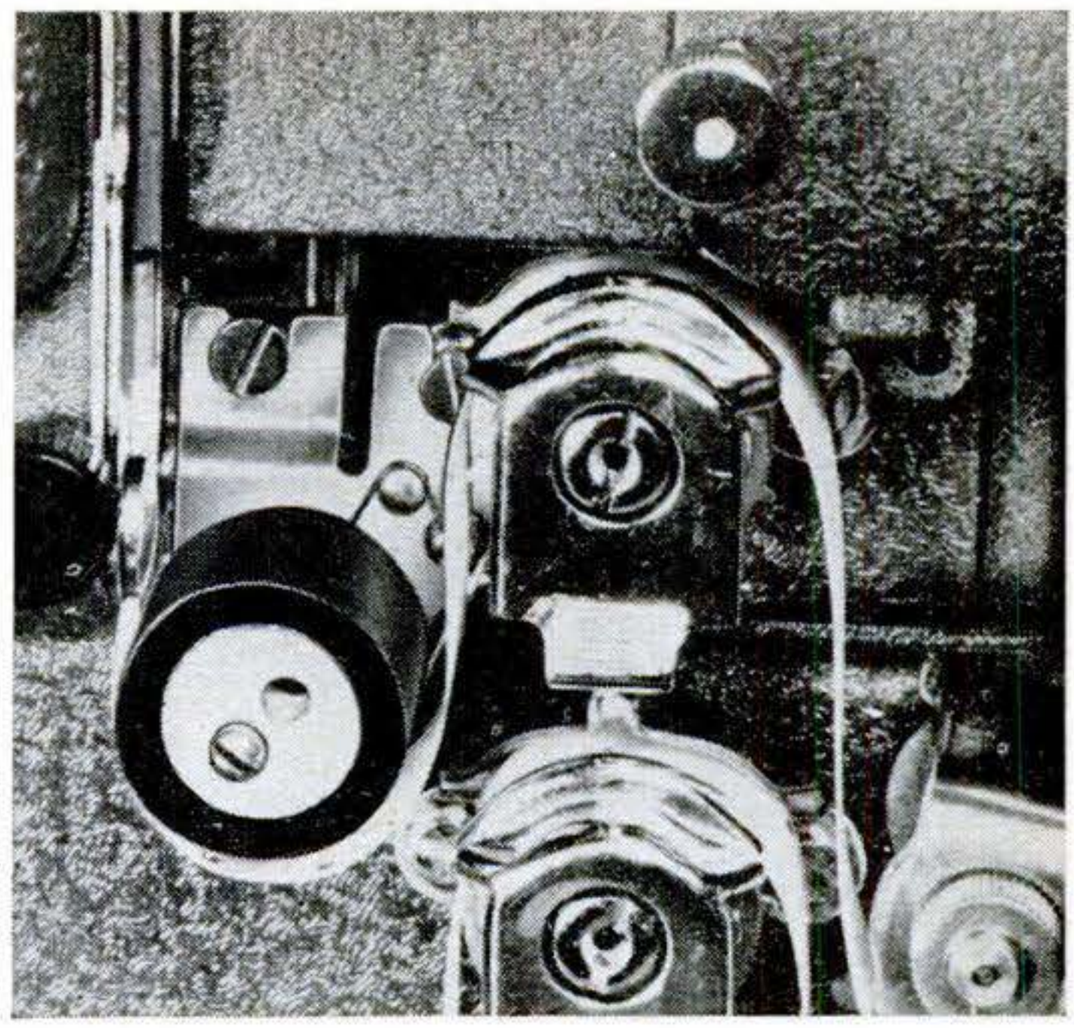


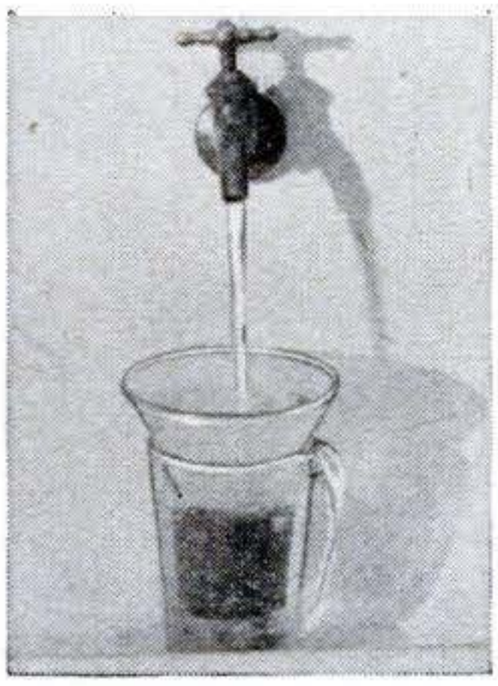
Frame Lights Transparencies. The light from a 4-watt fluorescent tube in the base of the frame is diffused through a block of clear plastic to light a color transparency. Chromo-lighter, made by the S. E. Overton Co., South Haven, Mich., comes complete with bulb and a 7′ cord with ballast. The company recommends letting the bulb burn continuously since it uses little current and it will last indefinitely if not repeatedly turned on and off. The little heat produced by the tube won't harm the film.

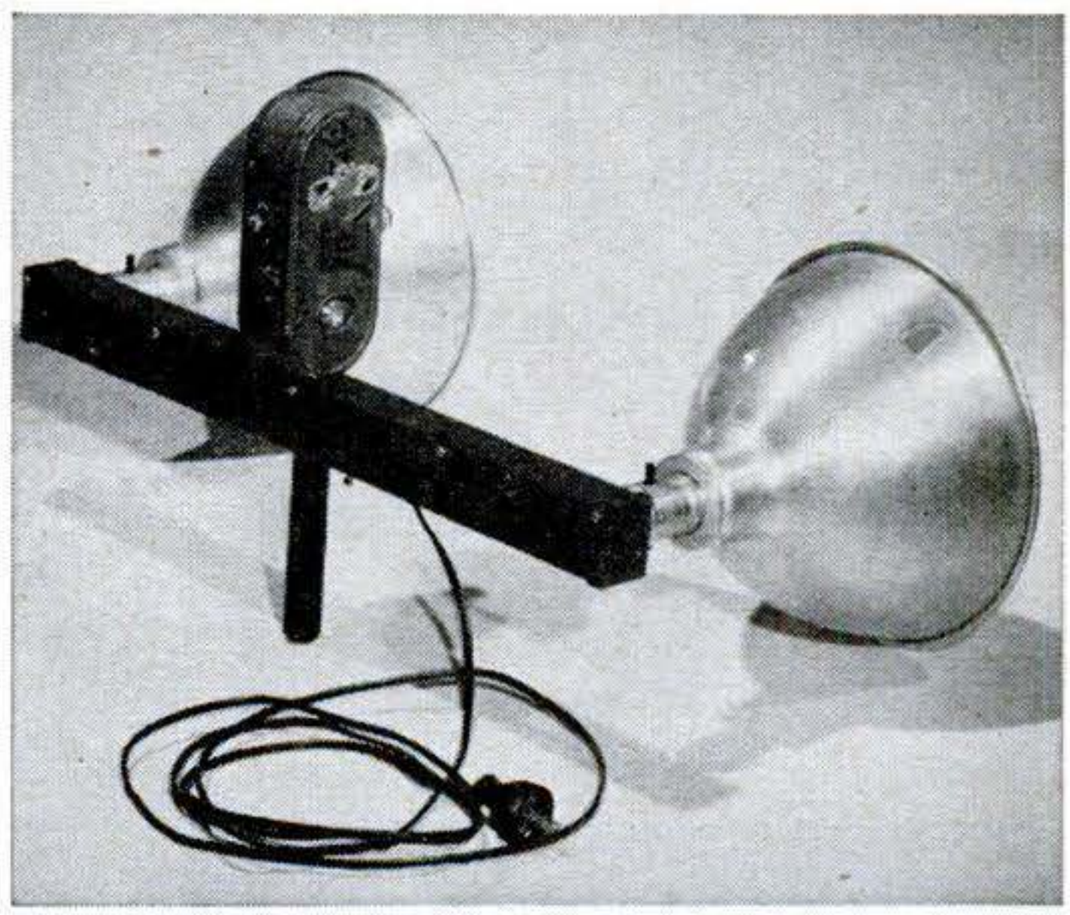


Roller Maintains Film Loops. The Morton Sentry®, for use on most 8-mm. and 16-mm. projectors, guards the lower film loop where 90 percent of film damage begins, according to the maker, the Morton Company, Minneapolis, Minn. Attached by screws already on the projector, the device is a roller pivoted off-center. When the lower loop starts to tighten, it contacts the roller which pulls the film past the damaged spot and automatically resets the loop with no interruption in the showing.

Enlarger Makes Color Prints. If you wish to make contact Printons® from color transparencies, your enlarger will let you use smaller and less expensive color-compensating filters. Otherwise you'd have to use filters as large as the transparency. Insert the filter in the enlarger and put the transparency and Printon on the easel.

Simple Negative Washer. Uncut roll film can be washed safely and efficiently with a funnel. Roll the film loosely and set it on edge in a beaker. Place the funnel so its lower end enters the center of the roll. Water is then forced upwards through and around the film, flowing over the beaker sides. Check to be sure the roll isn't too snug, unwinding it and rerolling it if necessary.—*Max Alth, Yonkers, N. Y.*





Light for Posing and Shooting. Called the Hi-Lo Lite® by the maker, Engineered Products Co., Cincinnati, Ohio, this twin fixture provides a low light for posing subjects and a high-intensity light for shooting stills or movies. A DPDT switch puts the lamps either in series or parallel. It lists for about $10 with aluminum reflectors, and about $7.50 without. It also can be screwed to a camera tripod.

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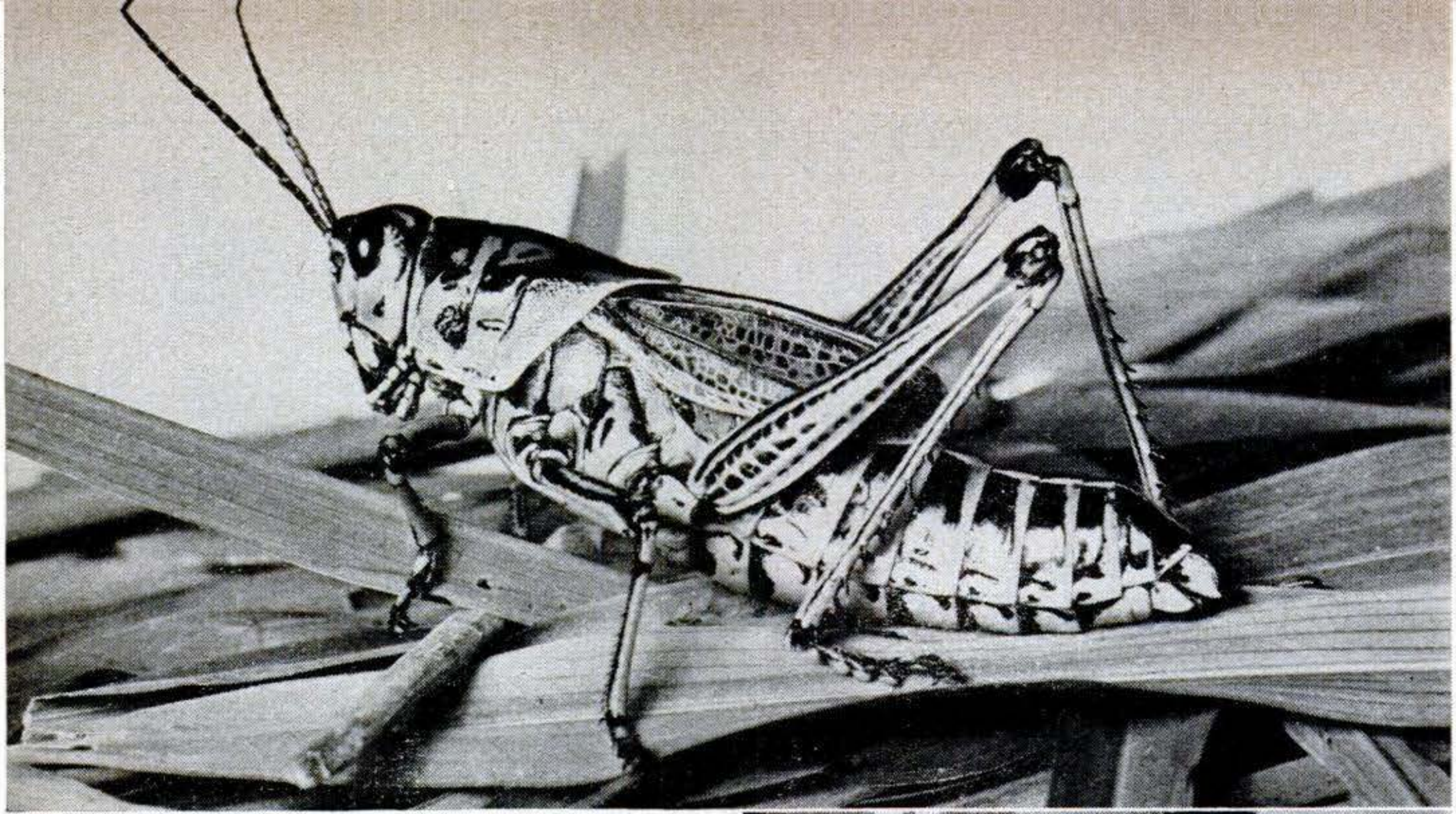
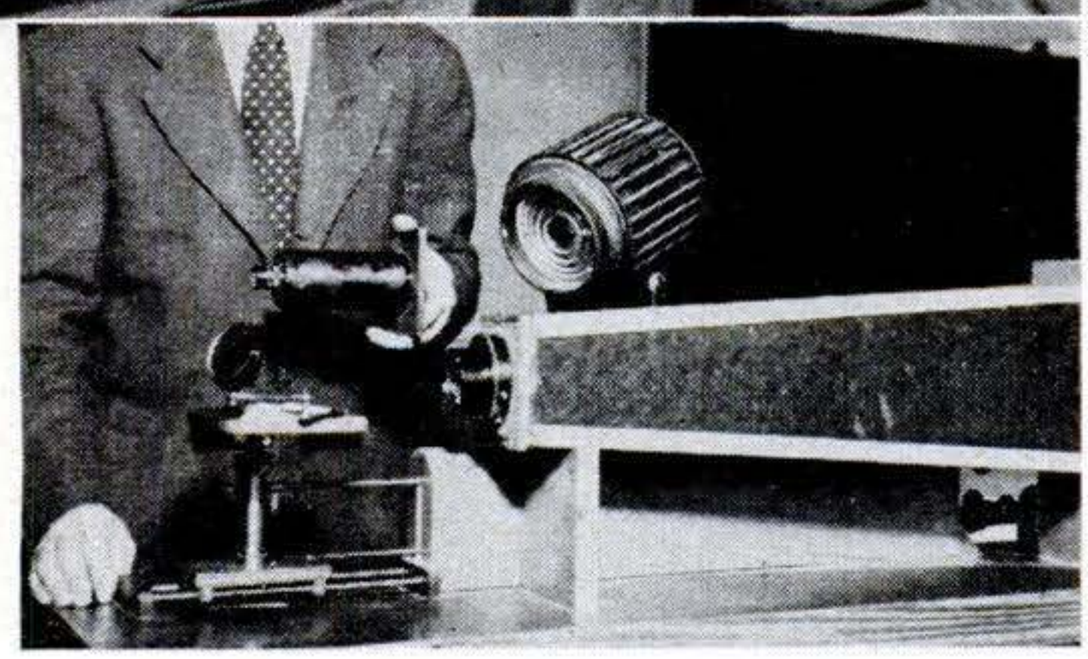


Camera Takes Bug Portraits



SPEED flash caught this grasshopper at 1/5,000th sec. The picture was taken with a camera built by members of the entomology department at Mississippi State College especially for photographing insects.

Of the fixed-focus type, the camera has no bellows. Instead, there's a 30″ tunnel formed of composition board, painted dull black inside. A slot at the back takes 4″ by 5″ film holders.

Specimens are posed on a stage attached to a rack and pinion from a dissecting microscope. To give back and forth adjustment, this in turn is mounted on a platform that slides on two parallel rods running to controls at the rear of the camera. Interchangeable lenses of different focal lengths make it possible to use the camera for large or small specimens. Considerable magnification is obtained with a 35-mm. lens. Speed flash is used for living specimens.

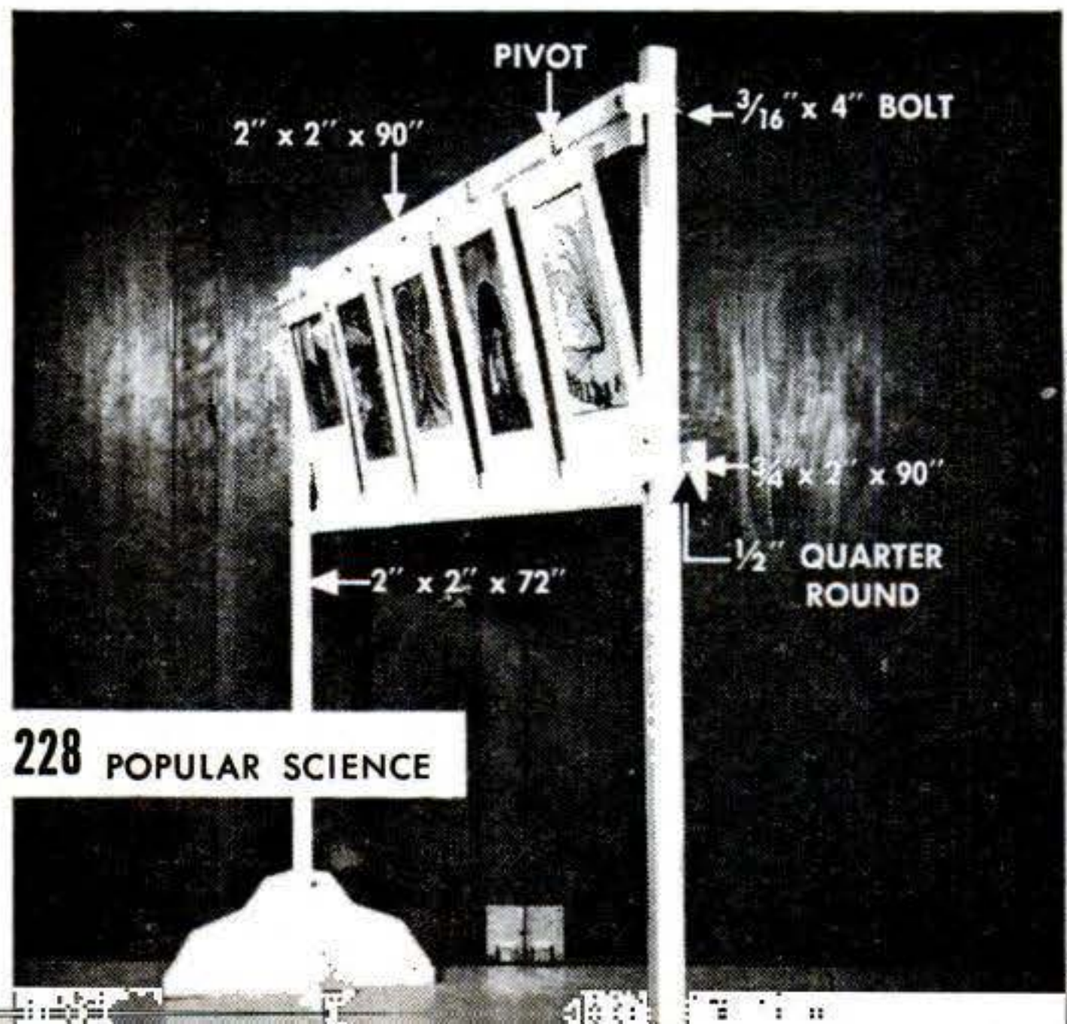
Easel Displays Prize Prints for Salon Judging

SOME photographers have long been dissatisfied with the old light-box method of exhibiting prints for salon judging. Unless prints are made especially for viewing in such light, they're apt to appear too harsh—and therefore unacceptable.

The display stand shown here is intended to solve this problem. Designed and built by Otto Litzel, of New York, it offers a good project for a camera club.

Glarefree, even illumination is obtained by using ordinary room lights, plus two 100-watt bulbs in 9′ reflector stands. The stands are placed about 10′ forward of the easel, one on each side. Prints are held at a 10-deg. forward tilt, eliminating all glare from the overhead lights.

Wing nuts allow the easel to be taken apart for storage when it's not in use.



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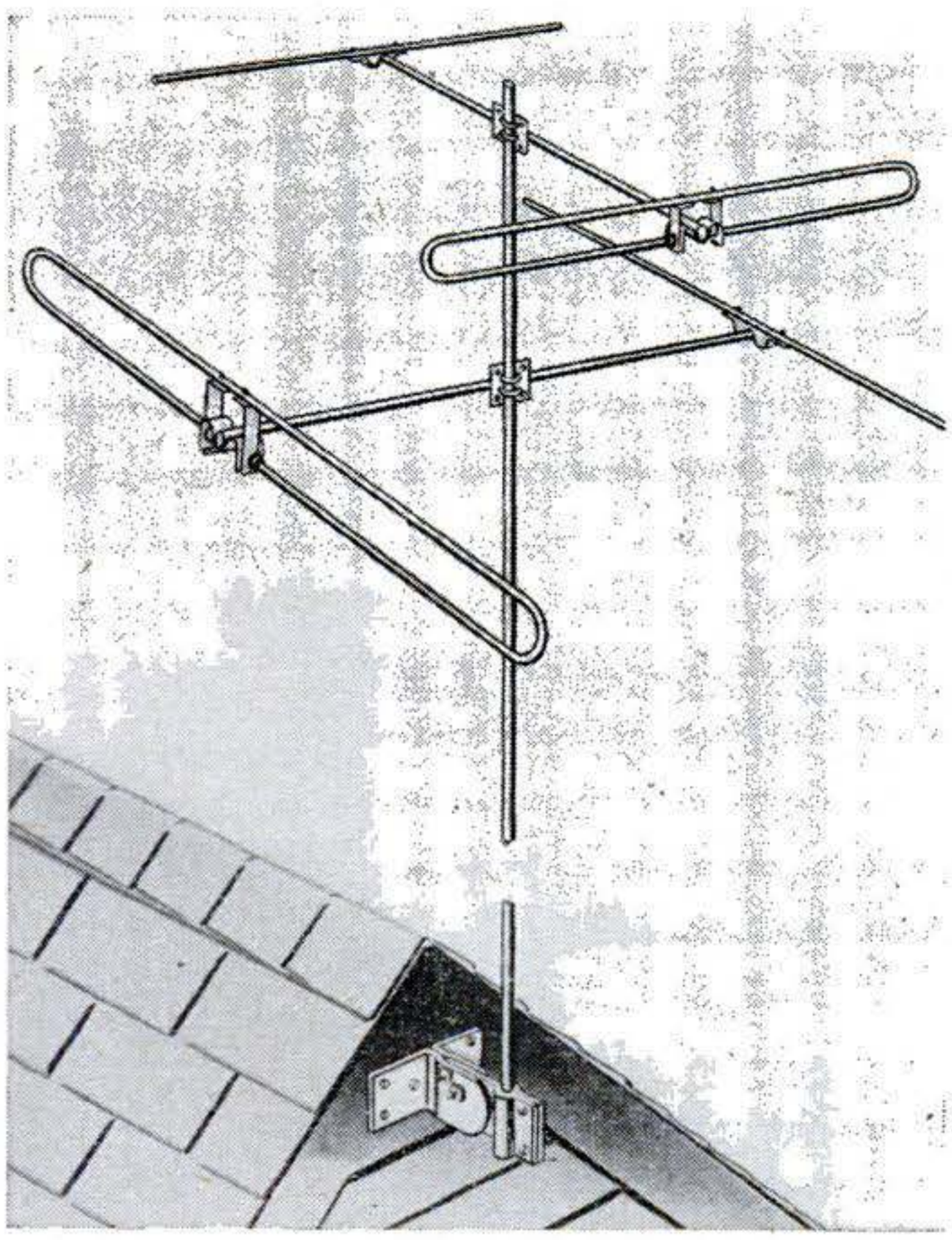
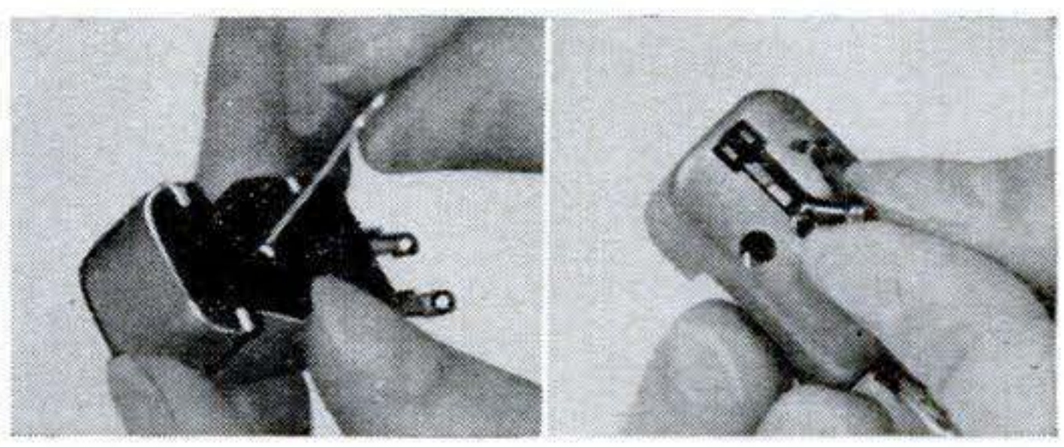
NEWS IN ELECTRONICS

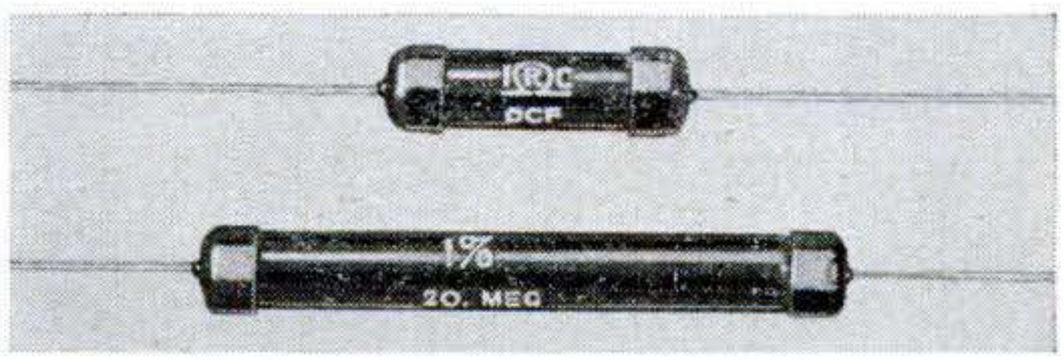
Projector Changes Slides. Semi-animation and a large degree of program continuity in slide-film showings are made possible by the new Soundview ® projector sold by Automatic Projection Corporation, New York. At the time the film and sound track are made, a high-frequency—7 kc.—tone is recorded on the disk at each point where a picture change is desired. This virtually inaudible sound triggers the slide-change mechanism. Stray tones can't trip the picture because the machine responds only if the note is of proper duration and amplitude as well as frequency.



Antennas Meet Local Needs. A new line of TV and FM antennas packaged by the L.S. Brach Mfg. Corp., Newark, N. J., eases the serviceman's work. The installer brings a flexible kit of parts to the job. Using a standard base mount and mast, he can add any combination of elements in any array to suit local conditions.



Stylus Is Replaceable. New GE variable-reluctance phono cartridges feature changeable needles. When the old stylus is damaged or worn, it can be pushed out and a new one inserted. In older models the entire cartridge had to be replaced. Styluses are still of the permanent type, good for thousands of plays.



Deposited Carbon Resistors. To combine economy and close tolerance, International Resistance Co., Philadelphia, makes these resistors by depositing crystalline carbon film on ceramic rods. The new units are made in 1- and 2-watt ratings, 1-, 2-, and 5-percent tolerances, and a broad range of resistance values.

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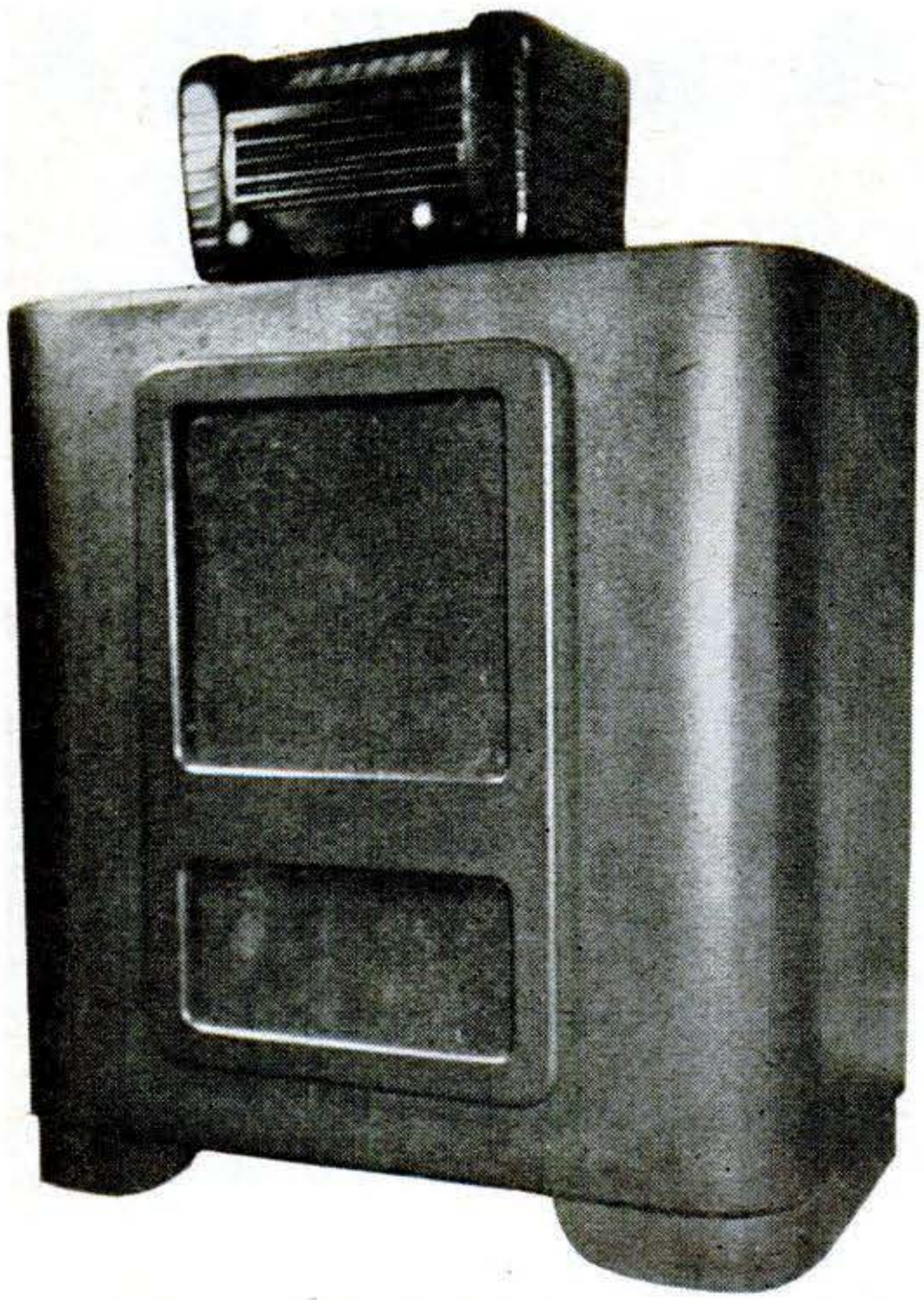
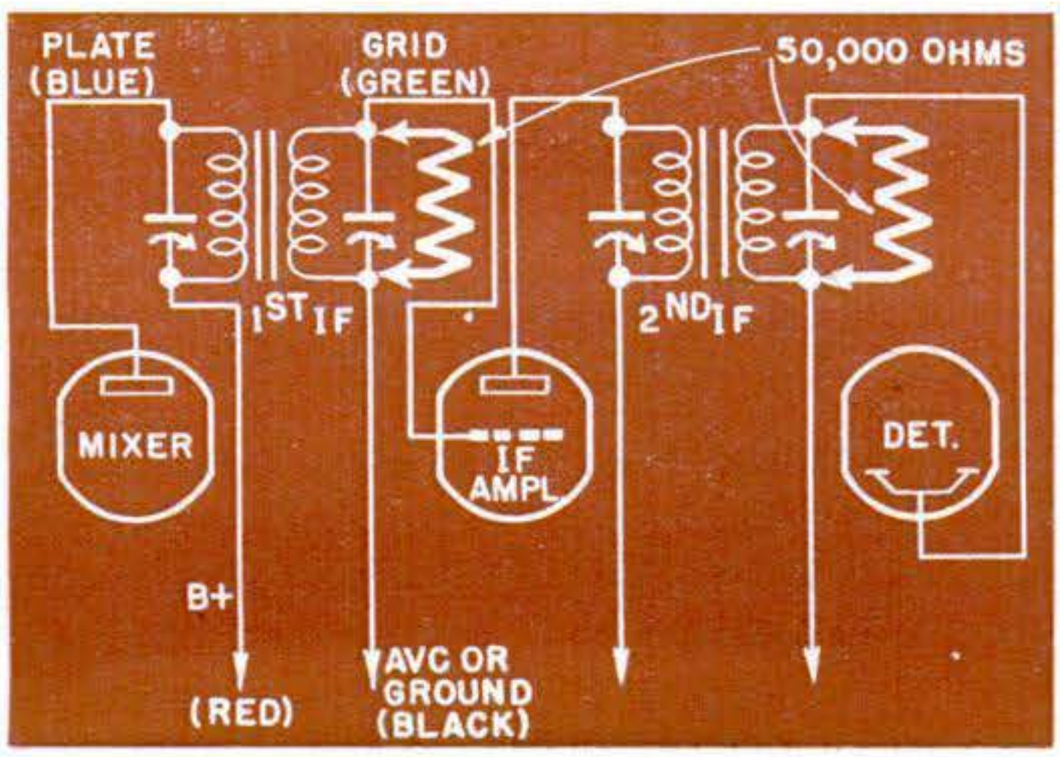
Getting Big-Set Quality from a Midget

By Joseph Saldana



A speaker cabinet helps you get full console sound quality from the modified midget on top.



1. Loading the secondary of an IF transformer with a resistor helps to broaden its response.

LIKE the legendary cobbler whose children went without shoes, I'm a radio engineer who has never owned a good receiver. A few months ago I grew tired of listening to the tinny squawks that came out of my little AC-DC midget, and decided that I wanted something better. That could have meant an investment of a couple of hundred dollars in a high-fidelity console or the expenditure of a lot of time—and money—in building an equivalent set from scratch.

I decided against both courses. Instead I modified my small set for better reception. Since then I have made similar changes in several other superhet midgets, always with remarkable improvement in tone. Deep bass notes which had been almost inaudible can now be heard in correct balance; high flute and triangle sounds come alive during symphonic broadcasts; and the entire response is smoother and has no harsh peaks.

Feeling that I could work better if I attacked the problem systematically, I broke the receiver into four sections. Ignoring the RF stage in each case, I began with the IF. The objective here is to increase the band-pass characteristics of the intermediate-frequency transformers and thus bring up the high-frequency response. There are at least three approaches to this, and which one you choose is a matter of convenience and cost:

1. Replace the IF transformers in the set with a pair of broad-band units. These may be purchased for about $3.

2. Load the secondary windings of both transformers with 50,000-ohm, ¼-watt resistors. These are connected from the grid to ground or AVC terminals as shown in Fig. 1.

3. If it is convenient to open the IF cans, move the windings about ¾″ closer together, as illustrated in Fig. 2. This increases the

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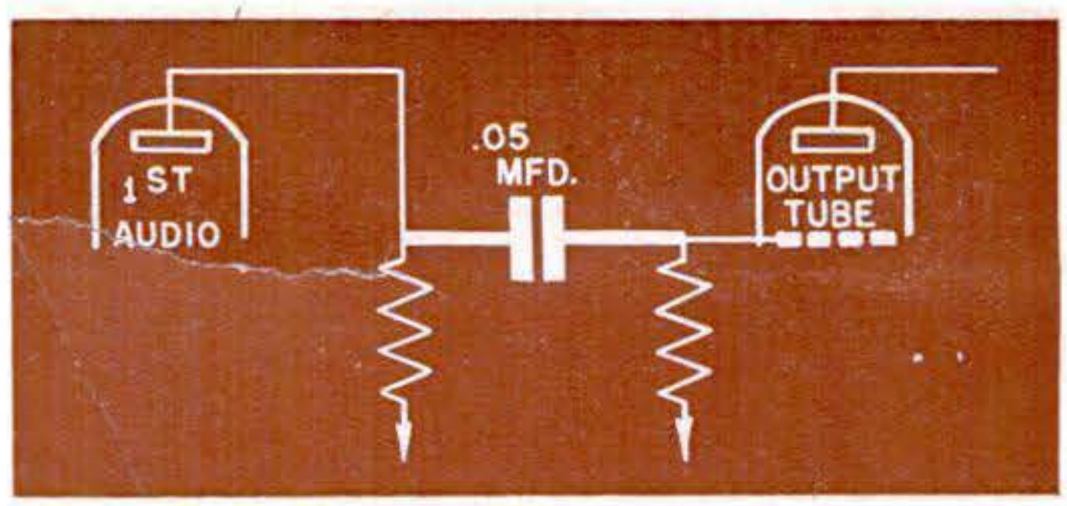
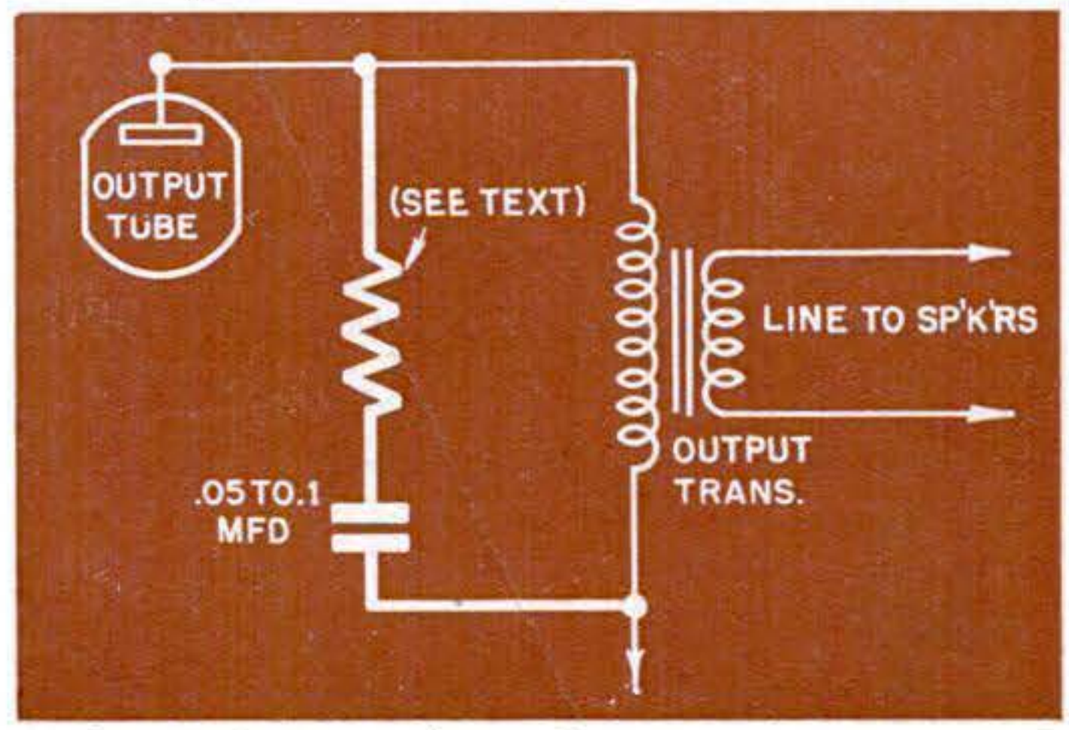
coupling and broadens the resonance peak. Take great pains not to damage the delicate wires. Heating the coil to soften the wax coating makes it easier and less hazardous to move the windings.

The next portion of the set to consider is the audio amplifier. Because manufacturers are anxious to keep hum level low, they usually use low values of coupling condensers in midget sets. These, in turn, limit the low-frequency response of the audio section. I substituted .05-mfd. coupling condensers in this section. A typical position for one of these capacitors is diagrammed in Fig. 3. In sets using single pentode or beam-power output tubes, an R-C (resistance-capacitance) filter can be used to advantage to smooth the high-frequency end. A resistor and condenser in series are connected across the primary of the output transformer (Fig. 4). This puts a more constant load on the output tube in the middle and upper frequencies, and thus improves the response. The resistor should be 1.3 times the value of the output tube's rated load resistance. You can check this figure by looking up your particular tube in a tube manual. The condenser may vary from .05 to 1 mfd.

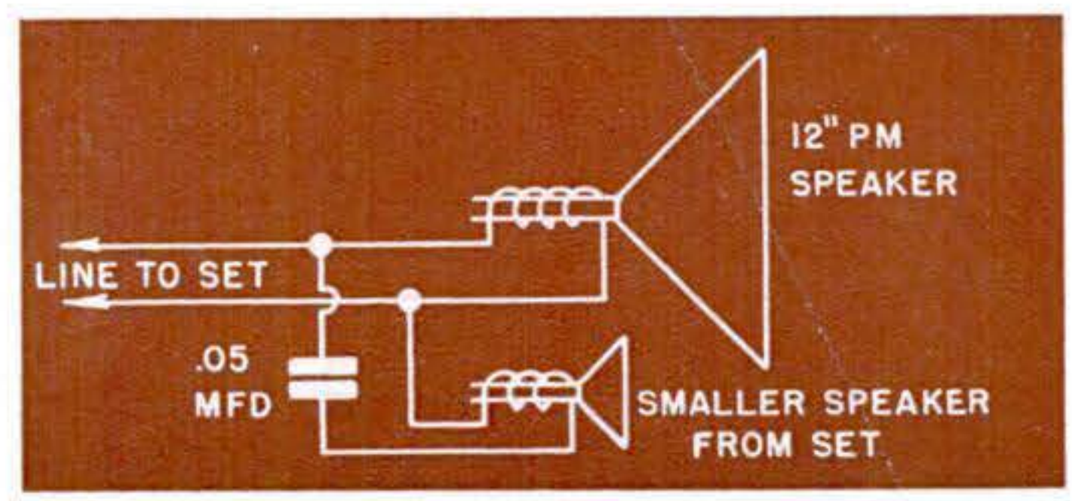
The third section to be attended to is the speaker system. Most midgets have 4" to 6" speakers that can't do much in the way of bringing out low notes but which can be used as tweeters or high-frequency reproducers. By purchasing a 12" speaker and connecting it in parallel with the one in the set, I had an effective woofer-tweeter combination. There are many more elaborate



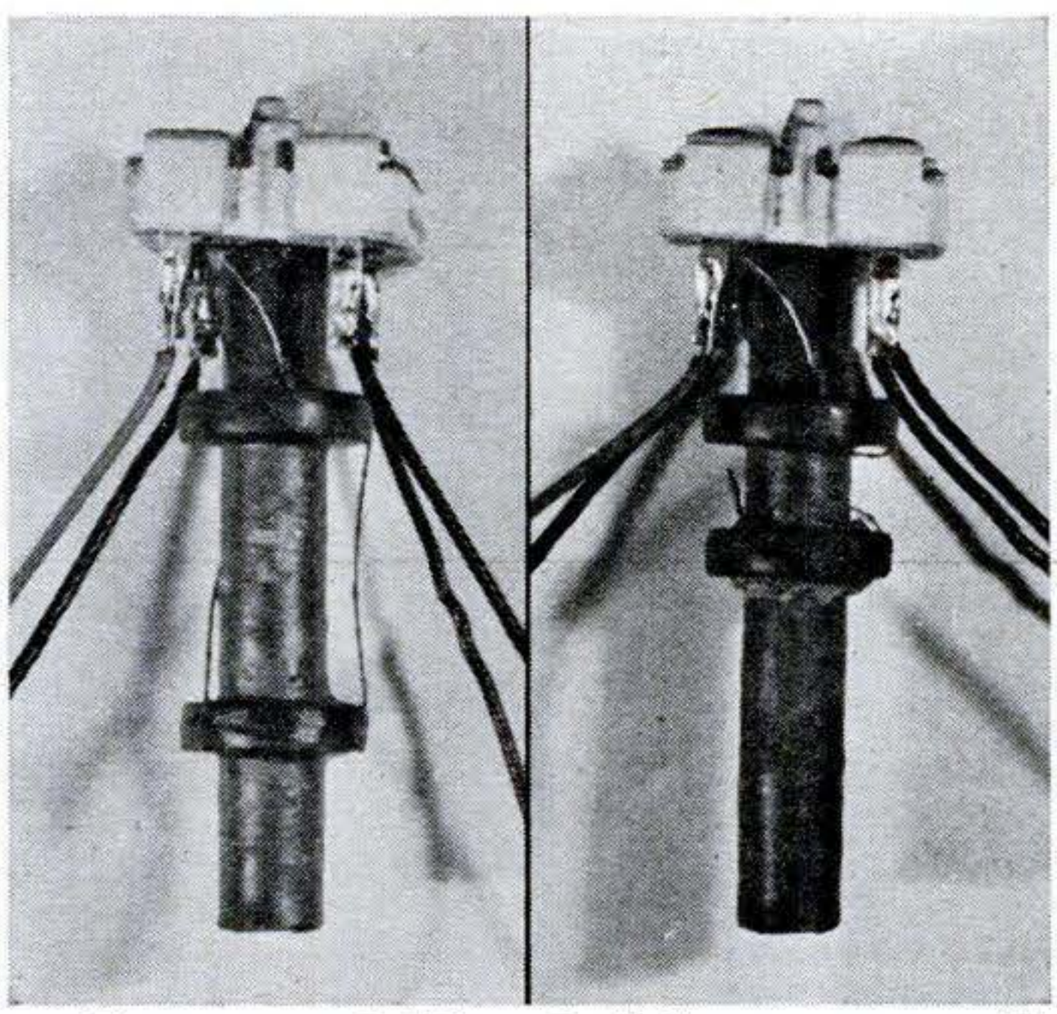
3. Bass is increased by changing the coupling condensers to .05 mfd. in the audio section.



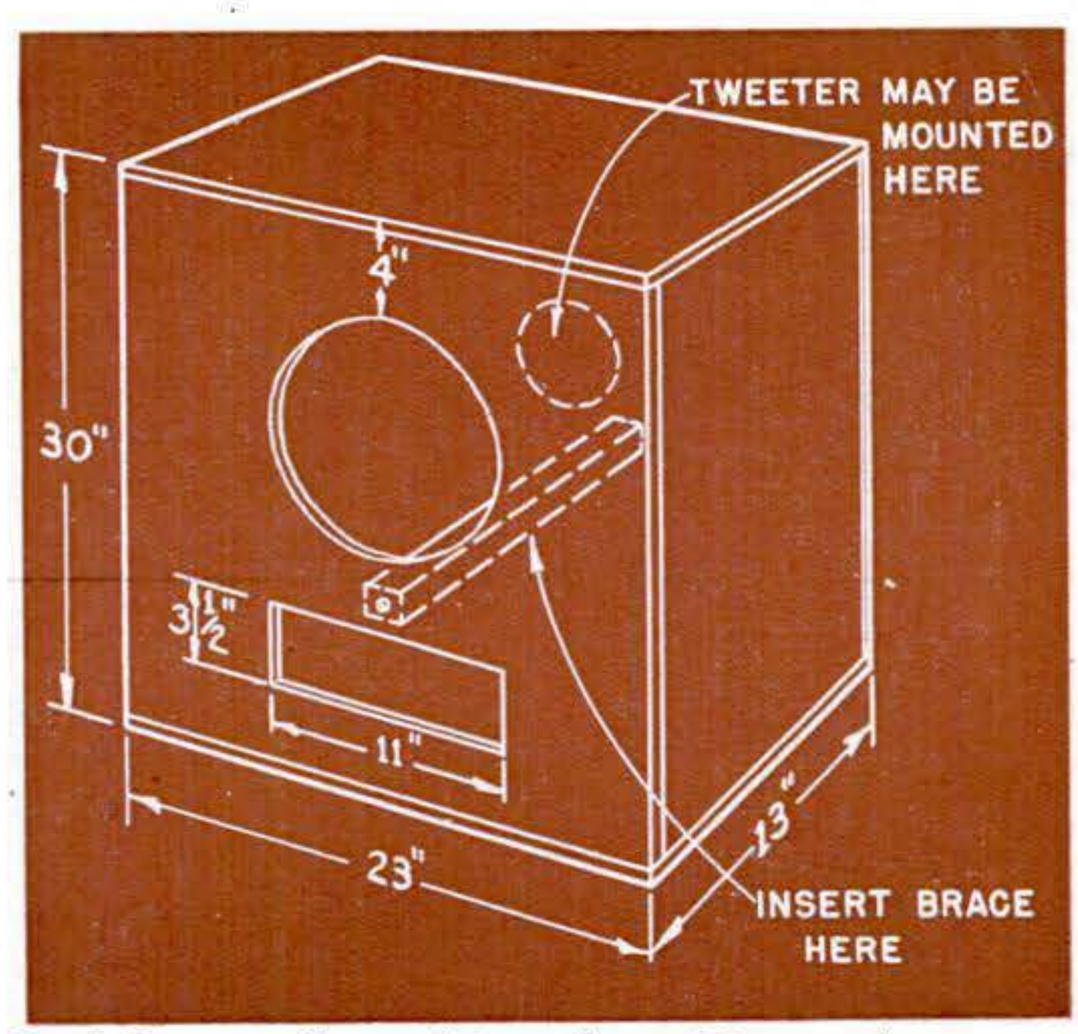
4. An R-C filter shunted across the primary of the output transformer smooths the response.



5. Use the original speaker as a tweeter and add a 12" woofer. A condenser divides the two.



2. The original IF coil (left, can removed) can be modified by moving the windings closer.



6. A bass-reflex cabinet for a 12" speaker may be made to these dimensions. Use ¾" plywood.

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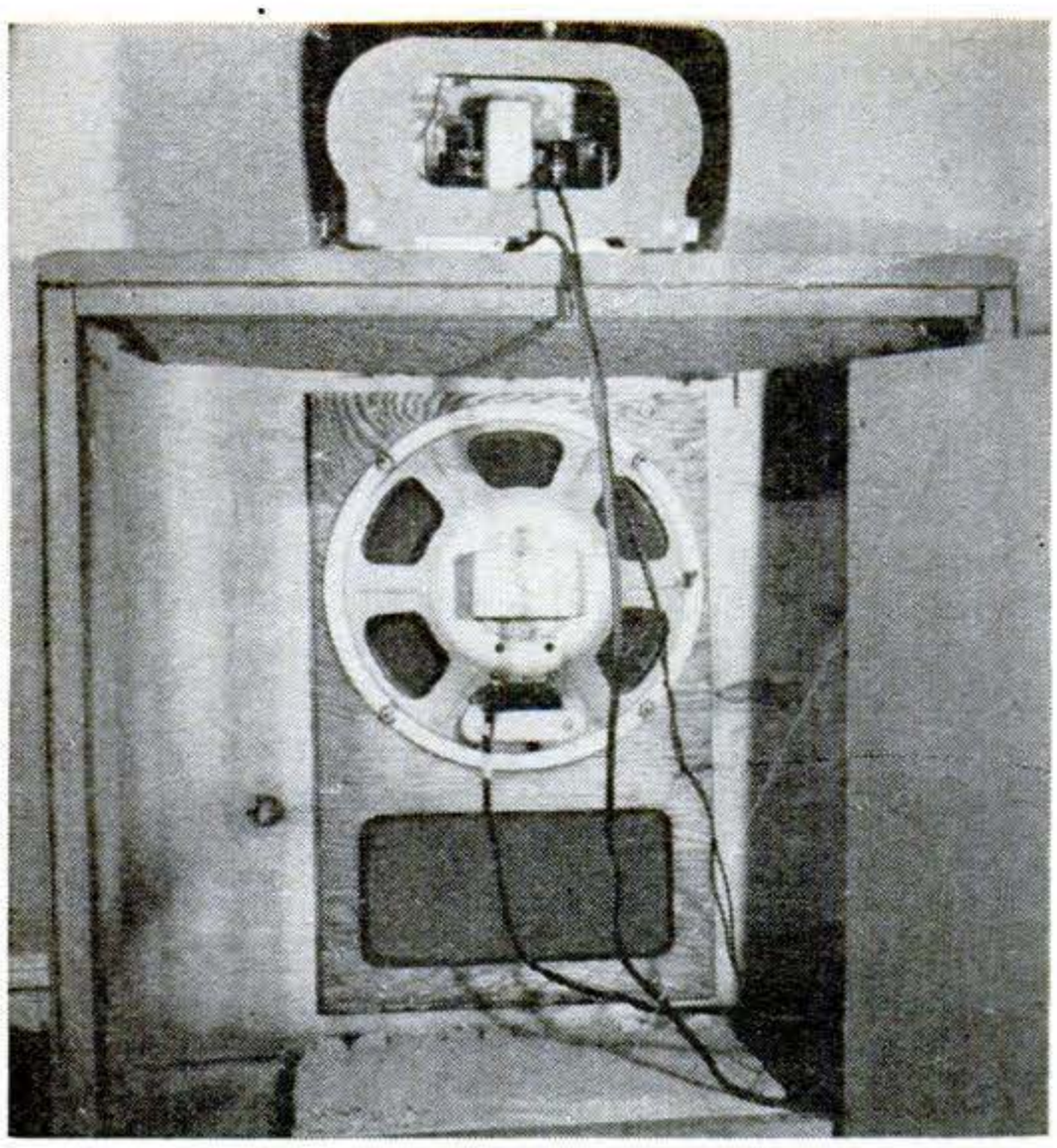
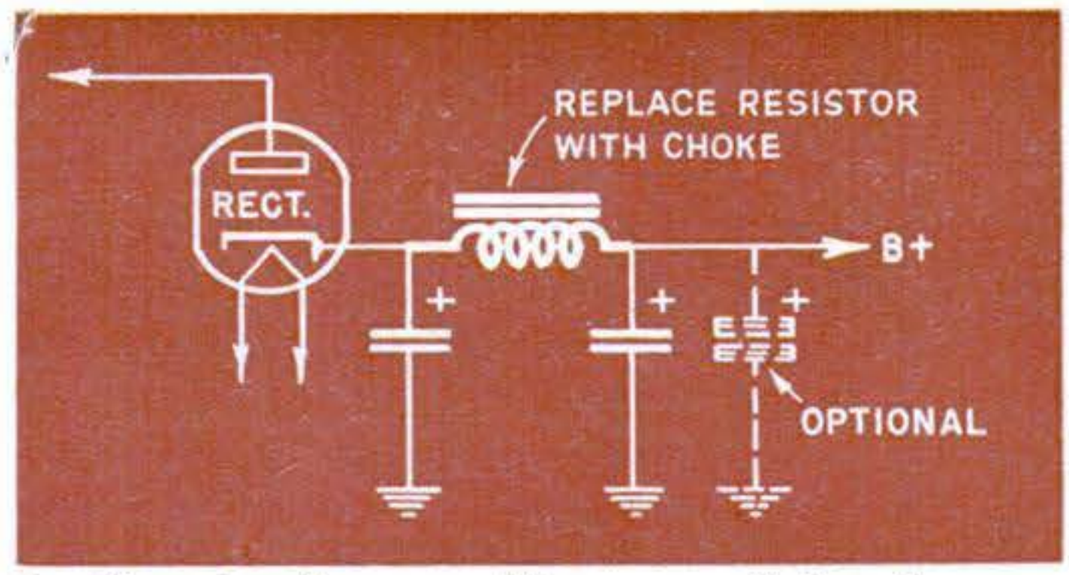


7. A commercial speaker cabinet seen from the rear. Set and small speaker are used near it.

divider networks and speaker systems possible (one is described on page 233) but for my setup I found it sufficient to insert a single .05-mfd. condenser as shown in Fig. 5 to keep low frequencies from getting through to the tweeter.

Cost is an important factor in the next decision. I purchased a bass-reflex cabinet to house my new 12″ speaker. You can do likewise, or build one to the measurements shown in Fig. 6. There are decided advantages to such a cabinet, since it gives extended bass reproduction without the annoying booming often encountered in other types of baffle. But also bear in mind that there are some very good sets that do not use speaker cabinets.

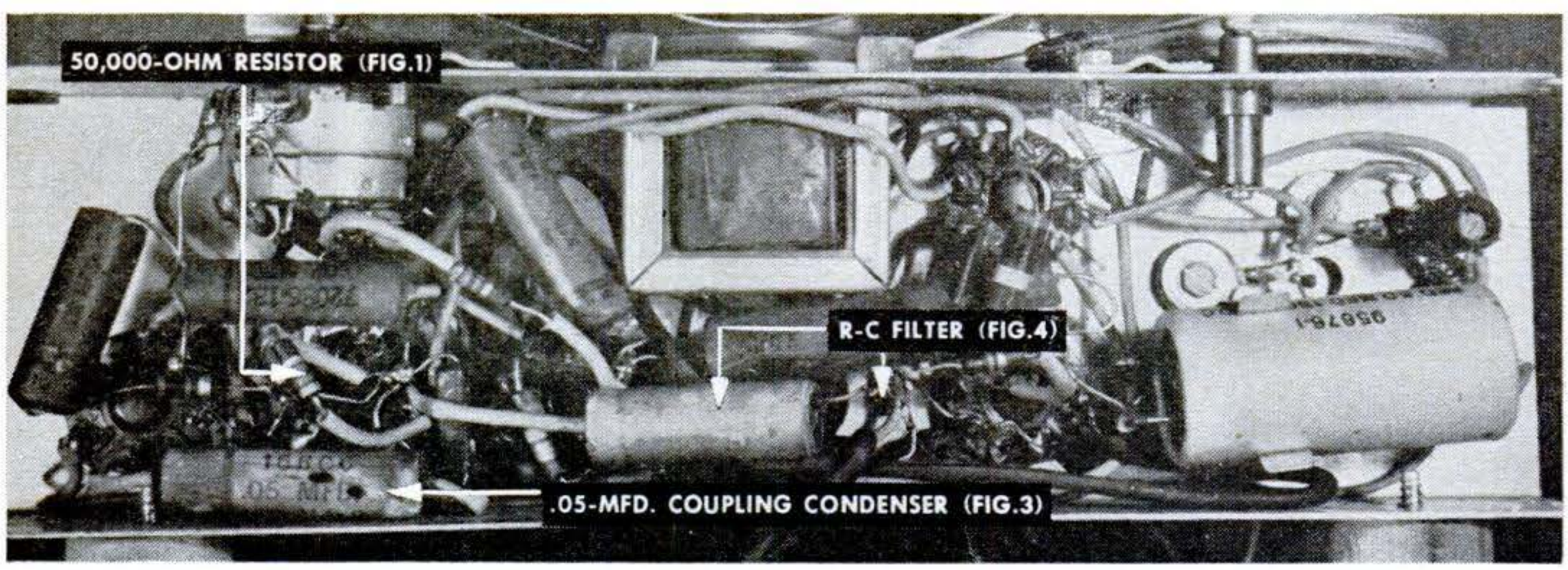
The tweeter may be mounted inside the speaker cabinet at approximately the point



8. Hum level is raised by some of the changes, so a new choke is inserted in the filter circuit.

shown in the drawing, or it may be left in the original cabinet if the two units are going to be kept fairly close together during operation (Fig. 7). Bass-reflex cabinets must be thoroughly enclosed on all sides. To prevent the back from rattling due to sound pressure inside the box, attach a sturdy brace to front and back as indicated by the dotted lines in Fig. 6. Line the cabinet with cotton batting or other sound-absorbing material.

Having completed the modification of the signal circuits, I found that I had worked myself into an additional job. By bringing up low-frequency response, I had also brought up the AC hum, which is in the same portion of the spectrum. In some sets I worked on, this was curable by the addition of extra filtering capacitors, but in most cases a small choke proved more useful. Remove the filter resistor (usually a 1,000-ohm, 2-watt unit) connected between the two positive terminals of the dual electrolytic, and replace it with a filter choke rated from 8 to 16 henries and 400 to 600 ohms. The higher the inductance the more thorough the hum filtering. If some hum remains, add a 20-mfd. electrolytic—rated at 150 volts or up—as shown by the broken lines in Fig. 8. END



A typical superhet midget looks like this. Some of the modifications are shown by arrows.

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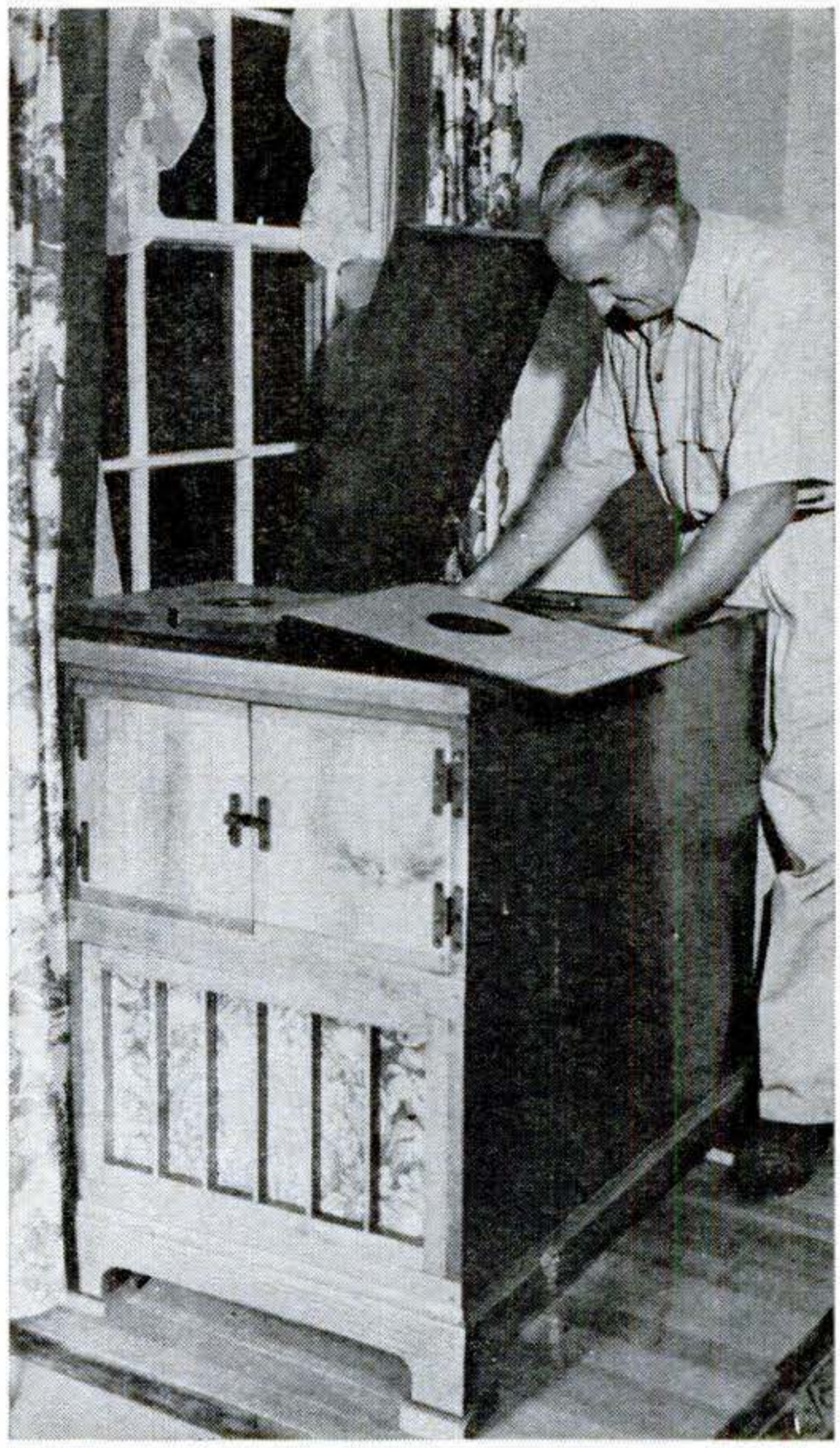
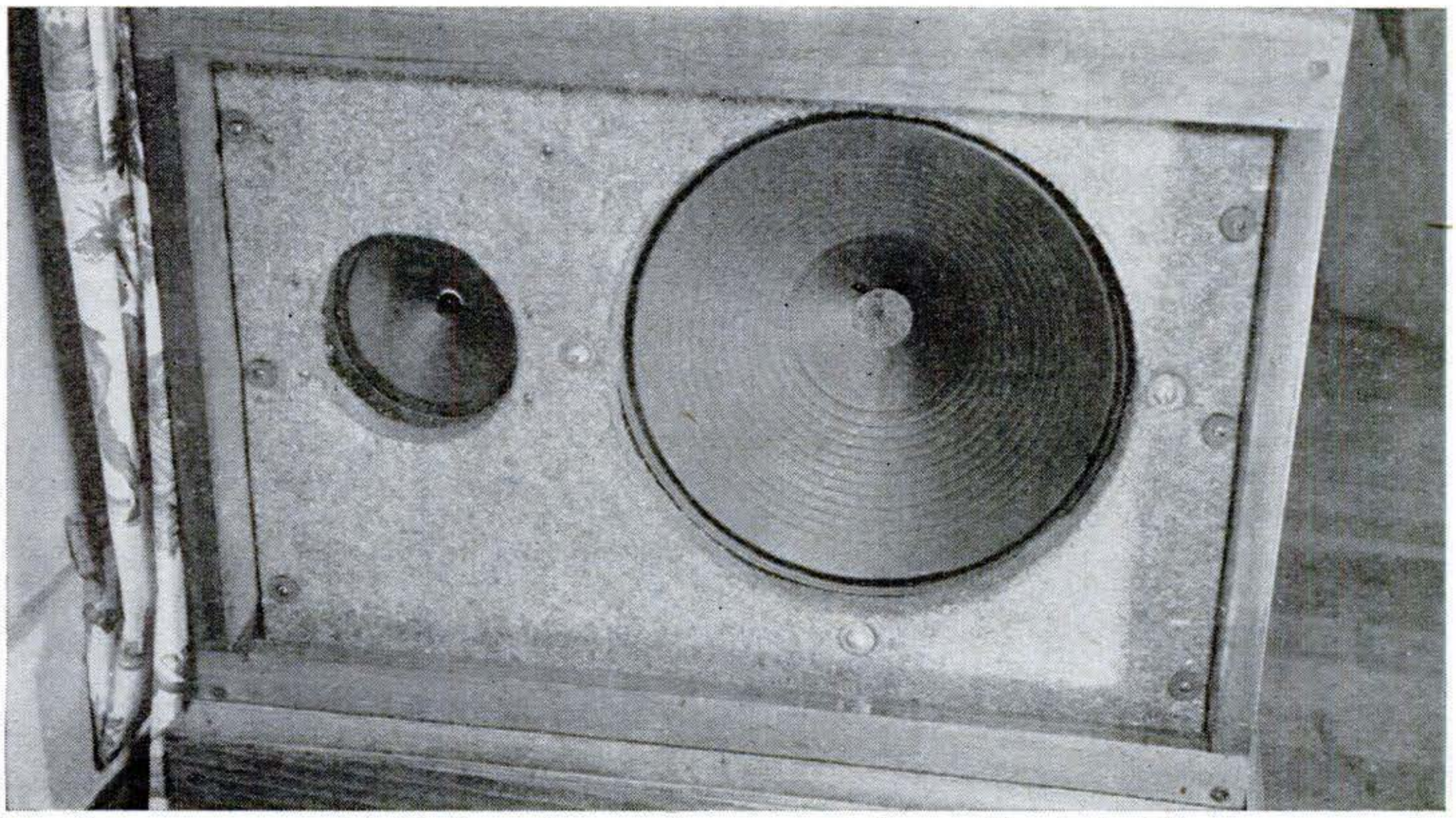
Bring Out High Notes with a Tweeter

IS THE loudspeaker bottlenecking your radio-phonograph? It is if you have a good audio system feeding into a single speaker. For no matter how much sound quality reaches the plate of the output tube, you'll only hear what the speaker can reproduce.

Single speakers are found in the overwhelming bulk of all radios and phonographs. For the most part they give adequate sound reproduction, but in many cases they do not deliver the full potential of the rest of the equipment—particularly with FM and the new wide-range records and pickups. The larger speakers—those



Dual speakers give you the full benefit of a well designed cabinet and a quality amplifier.



Speakers are mounted behind openings cut in a baffle made of soft fiber board. They are then covered by a grille cloth. The tweeter may be placed on either side or above the large unit.

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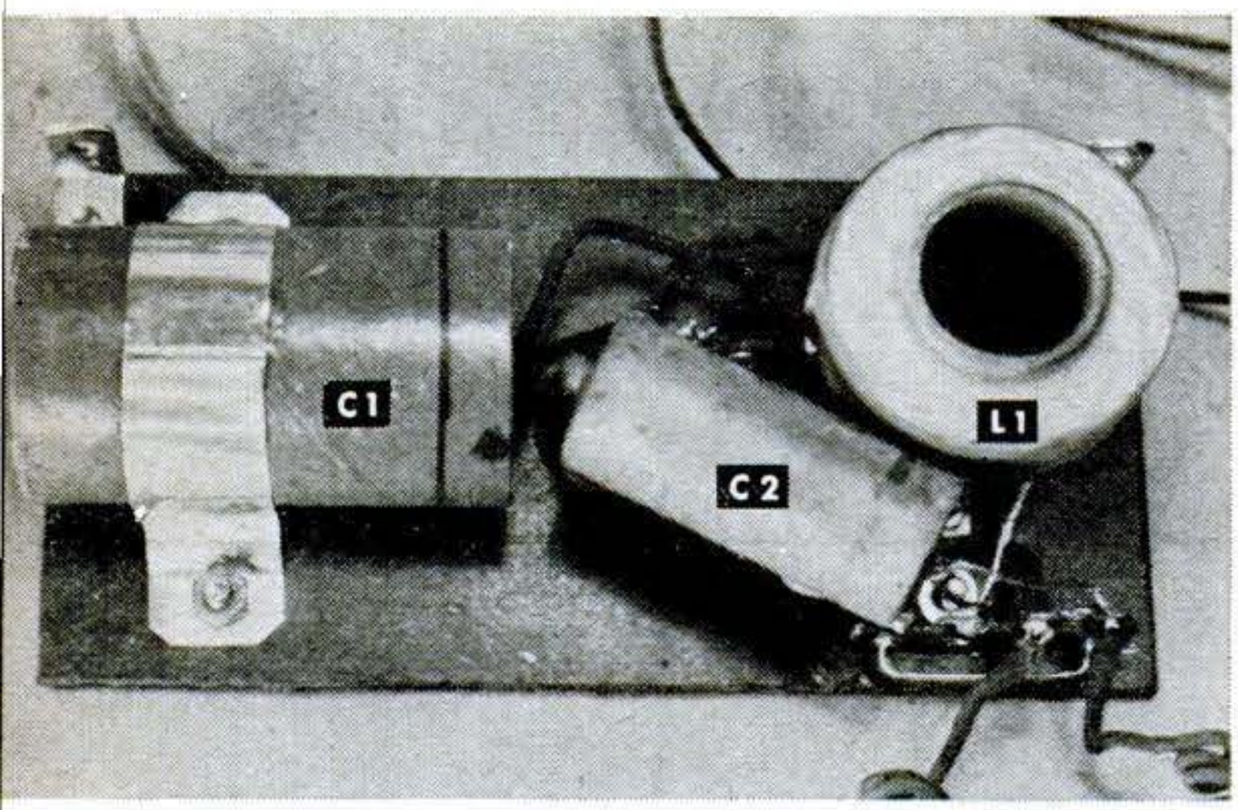
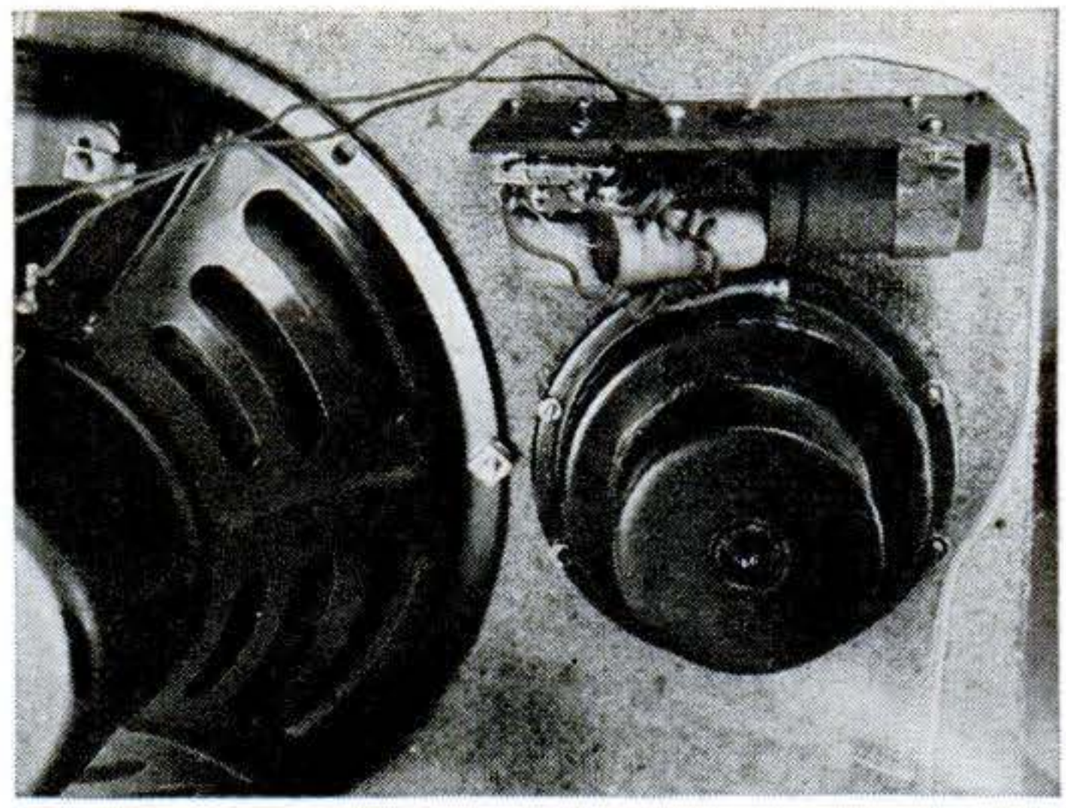
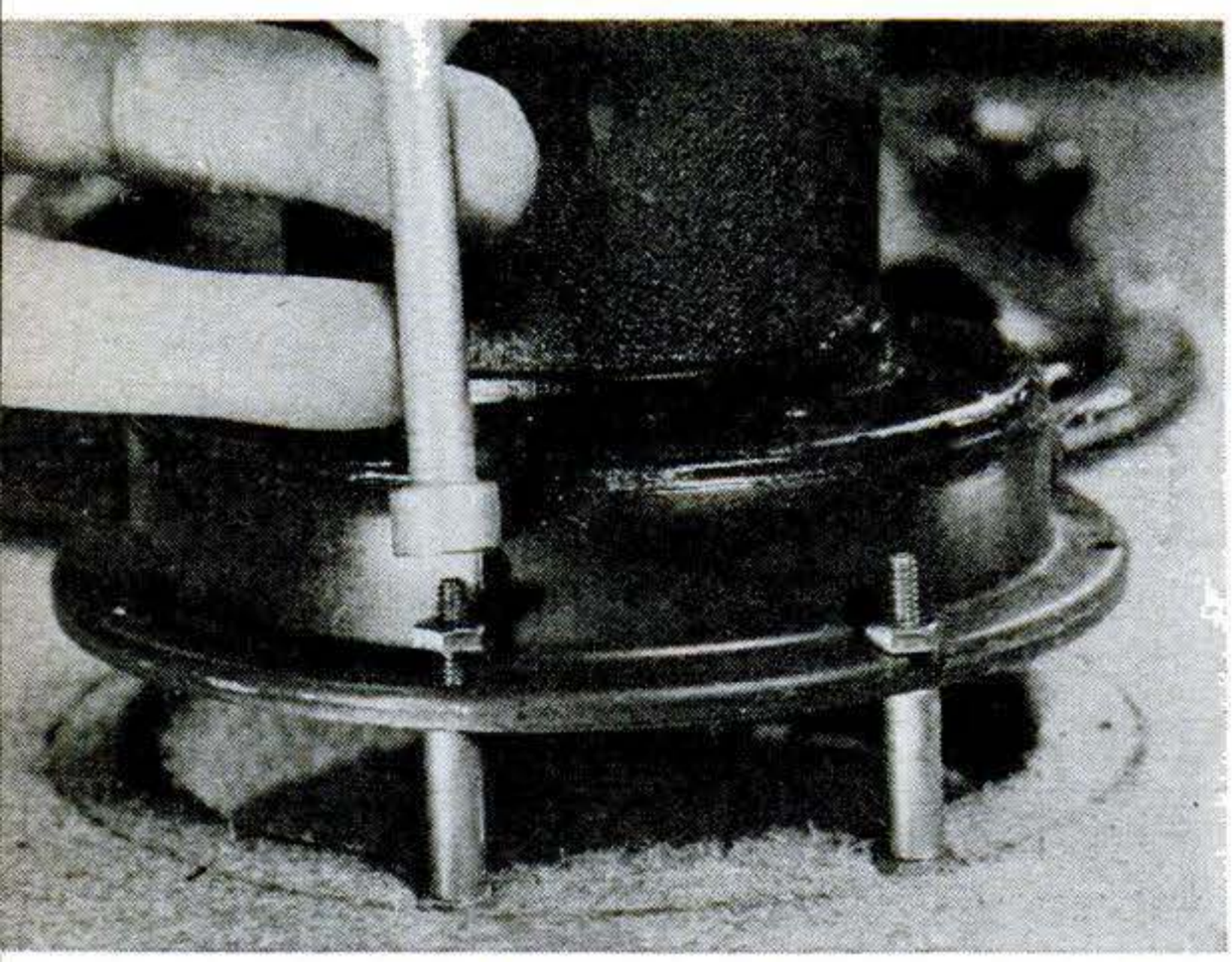


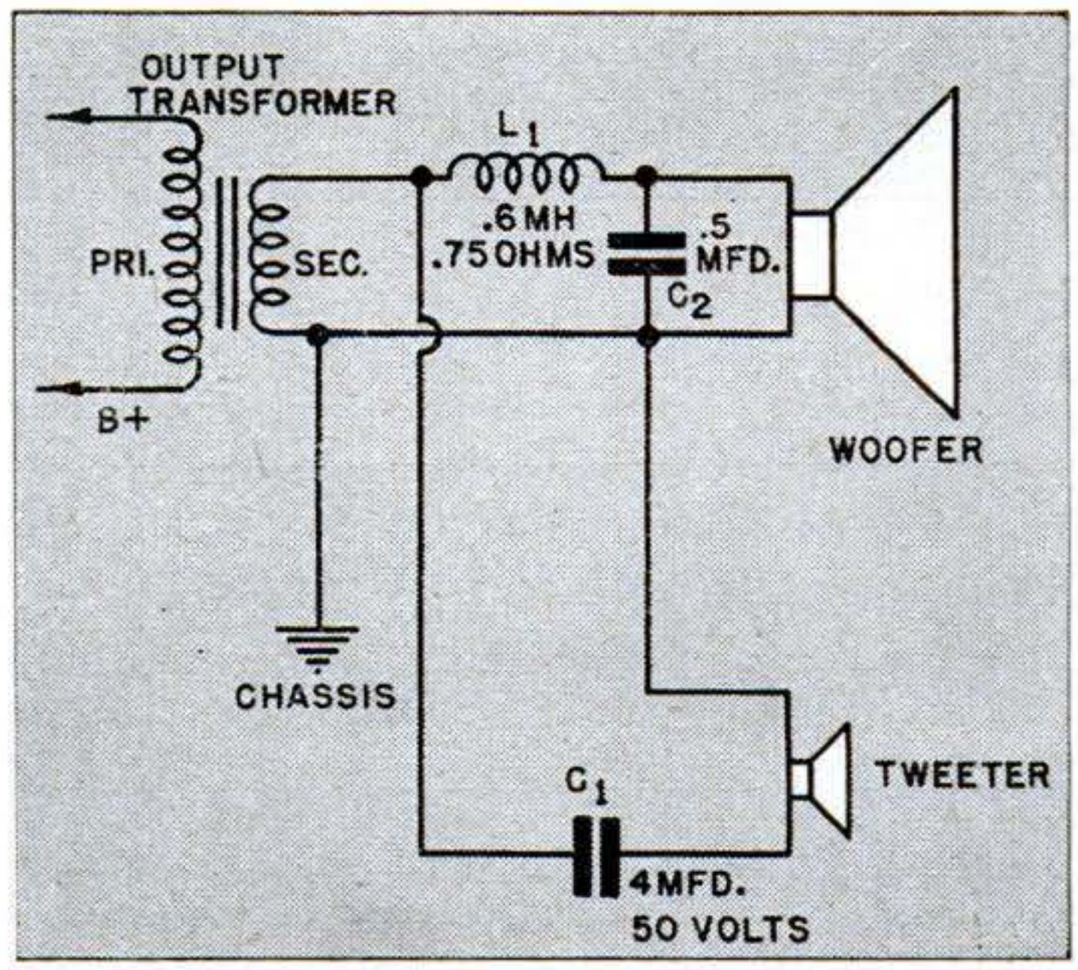
The divider network consists of two condensers and an RF choke, mounted on an insulating strip.



Place the speakers side by side on the baffle. The filter network is attached near the tweeter.



Spacing the tweeter on four 1″ metal collars minimizes reproduction of low-frequency notes.



Filter circuits for tweeters may be purchased prewired, or you can make one as shown above.

with frame diameters of 8″, 10″, 12″ or larger—are particularly good for reproducing low notes. However, while their large, free-moving cones boom out the bass well enough, they tend to muffle the high notes. To reproduce the latter sounds with fidelity, you need a tweeter.

Tweeters are small, rigid-cone speakers of about 3″ to 6″ diameter especially designed to reproduce all or part of the sound spectrum between 2,000 and 15,000 cycles. When combined with a large speaker—or "woofer"—and a dividing network, a tweeter will give greater faithfulness and brilliance to any music. In addition to increasing the range of your sound system, it will also improve the balance between high and low notes and separate individual instruments.

You can spend from $2 to $25 or more on a tweeter. The one in the photos cost about $8. It has a voice-coil impedance of 16 ohms, but in this circuit it works perfectly in combination with a standard 12″ speaker having an impedance of 6-8 ohms.

The dividing network includes a .6-millihenry, .75-ohm RF filter choke whose function is to keep high frequencies from the woofer. Low notes take an opposite path, since C1 blocks them from the tweeter while L1 passes them readily. Condenser C2 filters any stray highs that may have gotten past the choke. Note that C1 is a paper condenser, not an electrolytic.

Mount the two speakers on a fiber-board baffle. The tweeter should not be placed below the woofer; it is spaced off the board on four 1″ collars to discourage the reproduction of low frequencies. To obtain fullest emphasis of low notes you may wish to try a bass-reflex cabinet. Construction details are given elsewhere in this issue.—*Frank Tobin, Manhattan, N. Y.*

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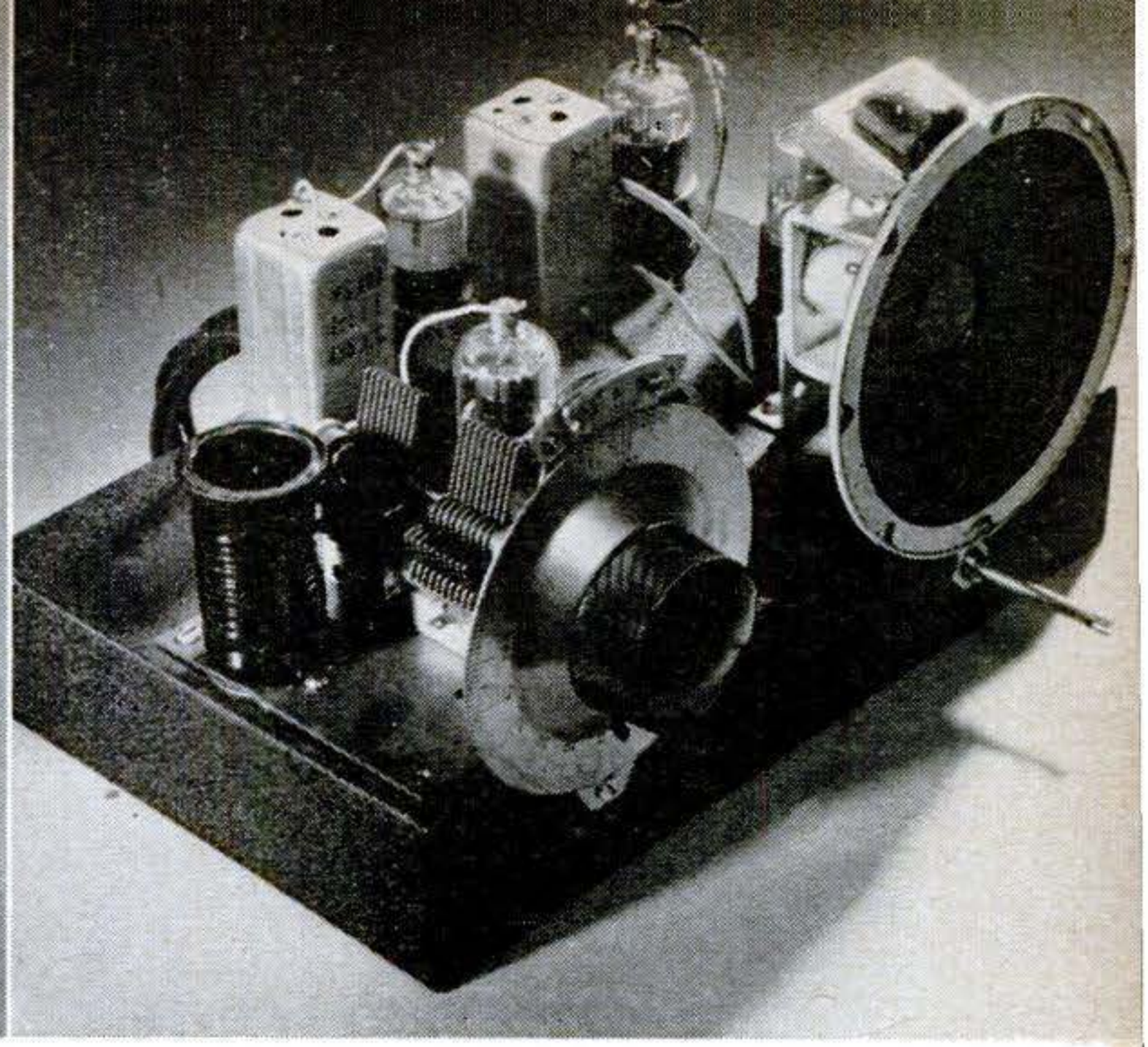
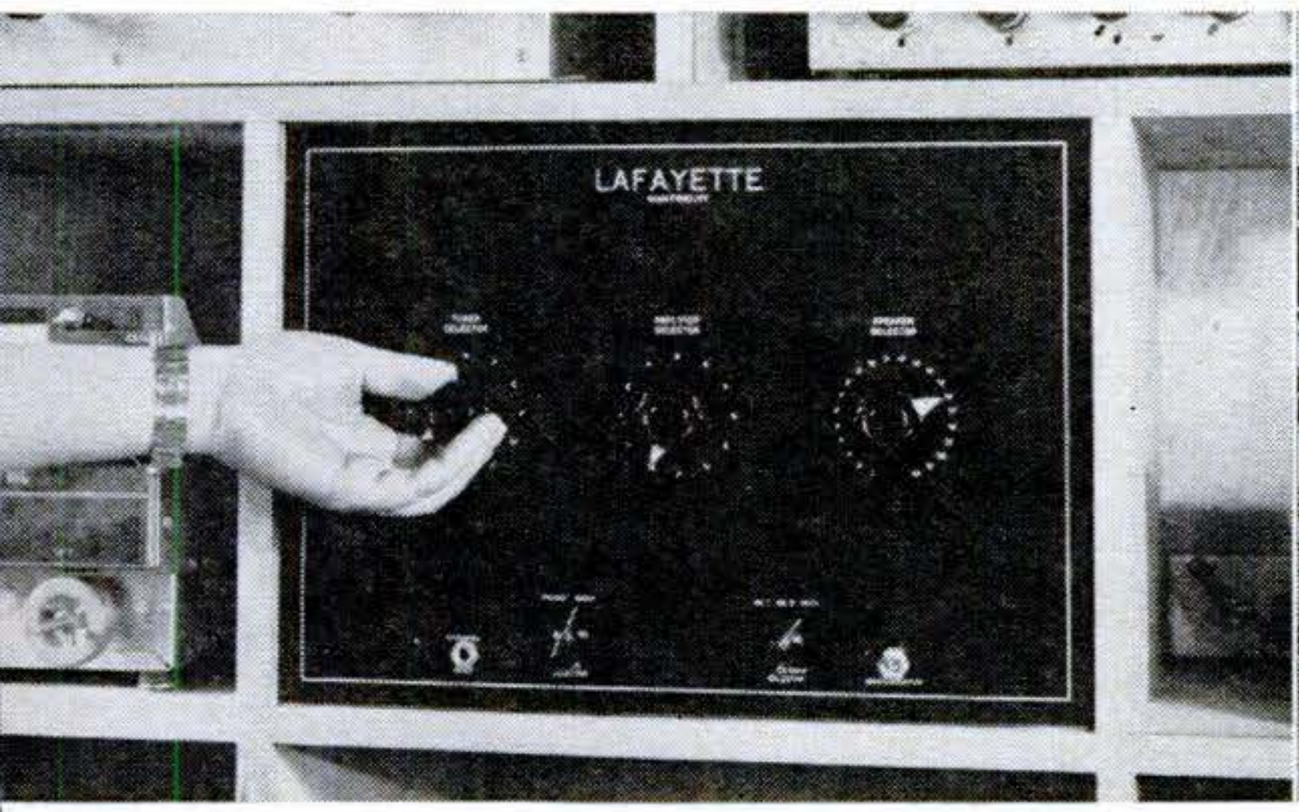


Shortwave Receiver Built on Half-Hour TV Show

STARTING from bare parts, a shortwave receiver was put together and working within 19 minutes recently while television cameras looked on. This demonstration of soldering virtuosity was performed by sound engineer Rudy Winston (left, above) on the "United Nations' Casebook", a regular program on New York's WCBS-TV. To save building a rectifier stage in his race against the clock. Winston used battery power. The completed four-tube superhet is at right above. Though the program lasted half an hour, Winston had only 25 minutes, as the script called for a view of the parts at the beginning and a demonstration of the receiver's performance at the end. By practising assembly in advance, Winston had the set bringing in overseas stations with six minutes to spare.

Purpose of the stunt was to dramatize one of the world's greatest needs—inexpensive, sturdy shortwave receivers. PS Editor Perry Githens, on the same program, showed charts indicating the terrific scarcity of receiving sets in countries where news and information of the United Nations should be made available.

Radio Selector Gives 145,000 Sound Combinations



PROSPECTIVE purchasers of radio-phonographs can now compare basic units to the tune of more than 145,000 combinations. Lafayette-Concord Radio, New York, recently opened the demonstration room partly shown at the right above. Racks containing 12 record players and changers, 12 FM, AM, or combination tuners, 48 amplifiers, and 21 speakers are arranged and wired so that any individual item can be joined with any other. Complete assemblies, less cabinets, are available from $75 to $1,000 or more; speakers alone range from an 8″ unit selling for under $9 to a 15″ one at $310. Four interconnected control panels of the type pictured take care of the switching.

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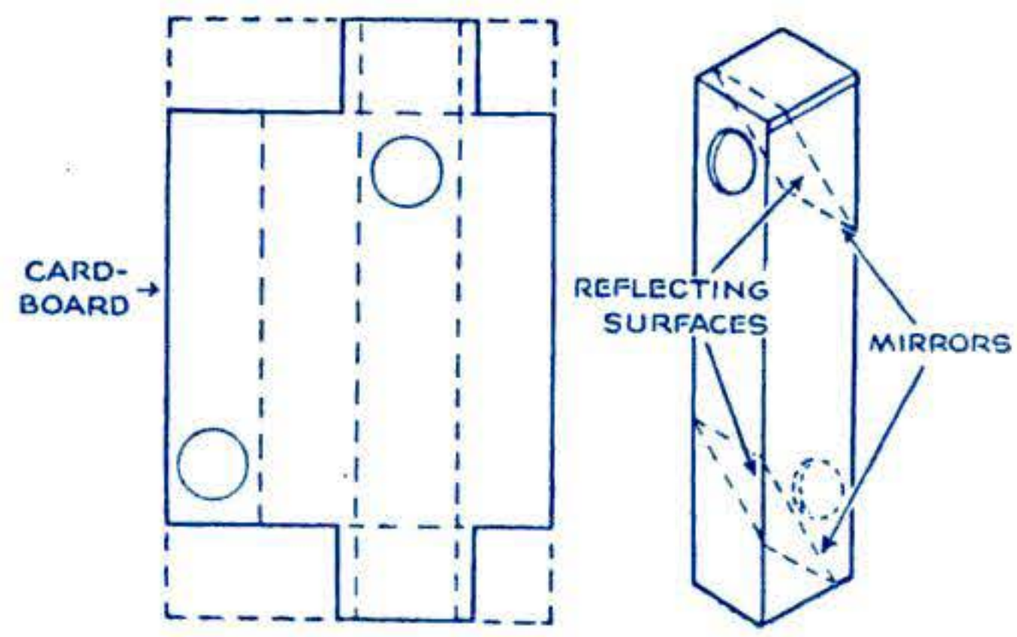
Love, String, and Sealing Wax

UNESCO booklet shows teachers in devastated countries how

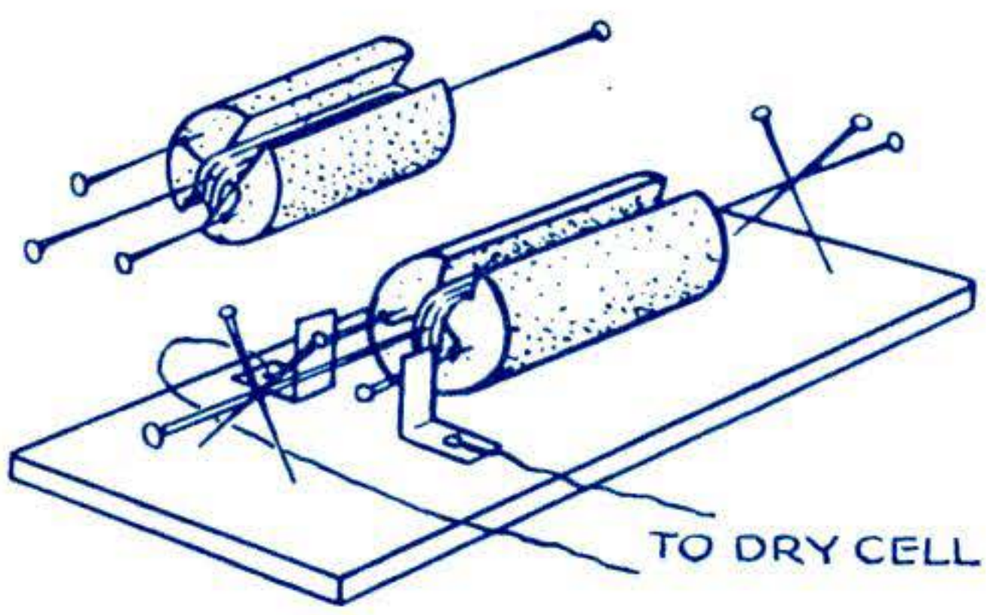
COSTLY, complicated equipment has its place in a modern laboratory, but brilliant scientific discoveries have been made without it. Archimedes and Galileo, for example, did fine with just simple things. And commonplace materials are all you need to teach your youngsters basic science.

Sometimes modern scientists question the trend toward ever-fancier lab equipment. The title above is based on a phrase in a lighthearted song called "Take Away Your Billion Dollars," written by Arthur Roberts, an American physicist. The song's main point: ideas come first, equipment second. You *can* get along with simple things.

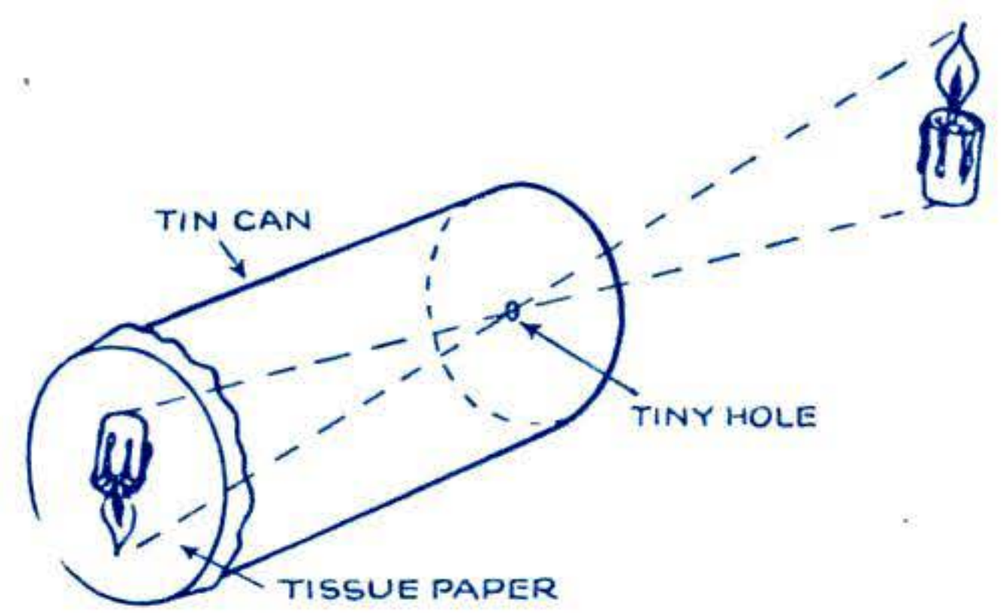
This is also the theme of a booklet prepared by the United Nations for teachers in war-devastated countries. On these pages are some of the experiments it suggests. All drawings were adapted from the booklet.



Periscope. Talk about submarines and a youngster is sure to ask: What's a periscope and how does it work? In a sub, the periscope is more elaborate than this toy, but it works exactly the same way.



Electric Motor. You can make one with a horseshoe magnet, a cork, a few pins, and scraps of tin or copperfoil. The armature is a coil of thin insulated wire wound in a groove cut with a razor blade in the cork. The ends of the wire are wrapped around two pins that serve as the terminals through which the current enters and leaves the coil. Leads from a dry cell attached to the brushes feed power to the motor.



Pinhole Camera. However fancy it may be, any camera is just an elaboration of that earliest picture taker—the pinhole camera. Here's one you can rig up in a couple of minutes. You'll get best results by looking at the screen in a darkened room. Keep the hole as small as possible for greatest sharpness.

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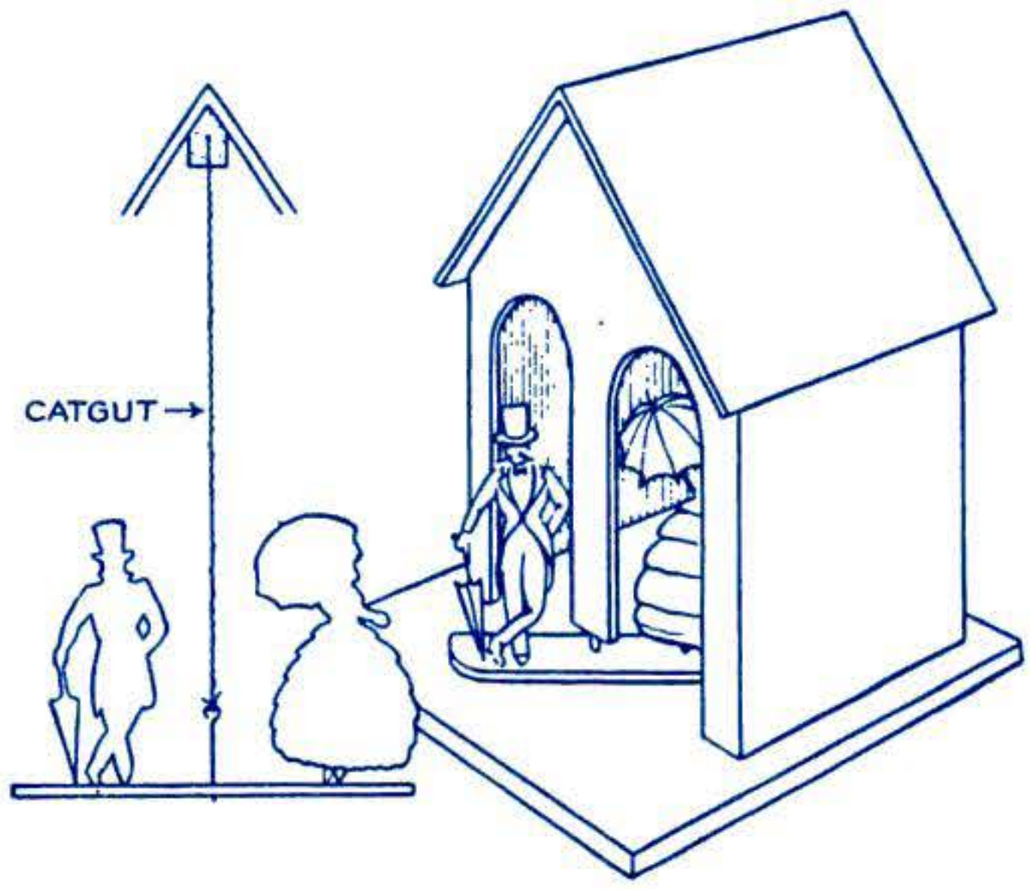
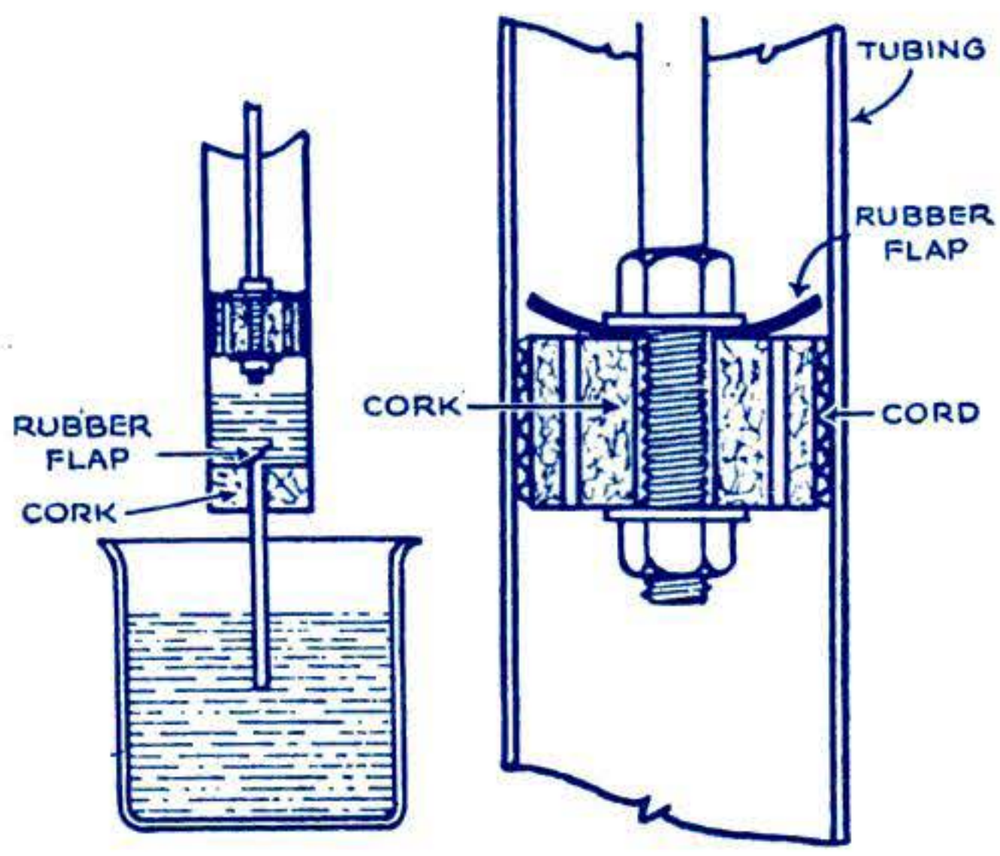
Keep Science Alive

everyday things can be used to demonstrate basic science

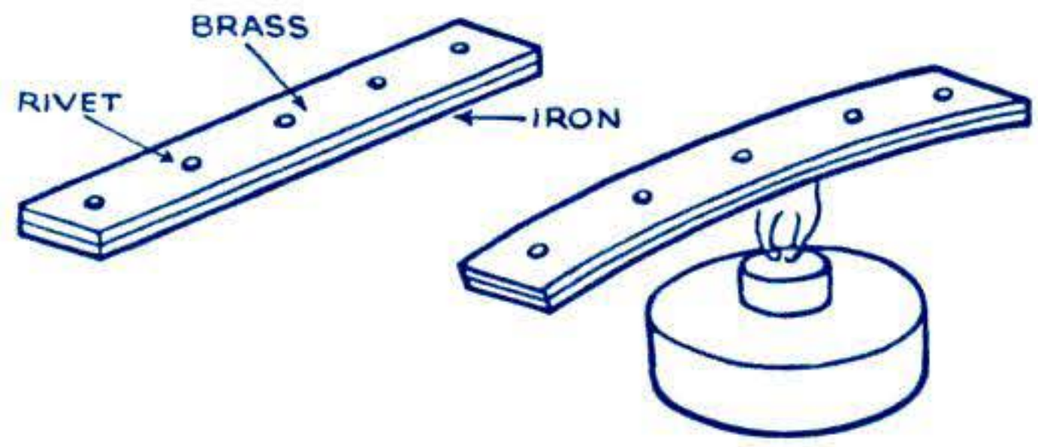


Weather House. When the atmosphere fills with water vapor, rain is in prospect. Variations in the amount of moisture present are indicated by an instrument called a hygroscope.

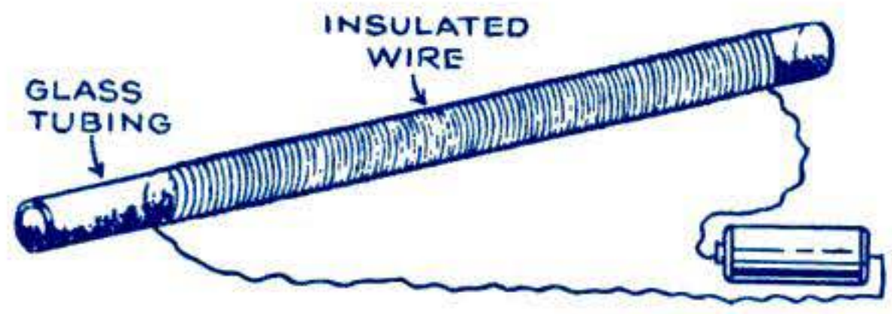
The common weather house is an example of this instrument. You can build one, using the hygroscopic properties of a piece of catgut. The direction of twist of the gut can be found by trial.



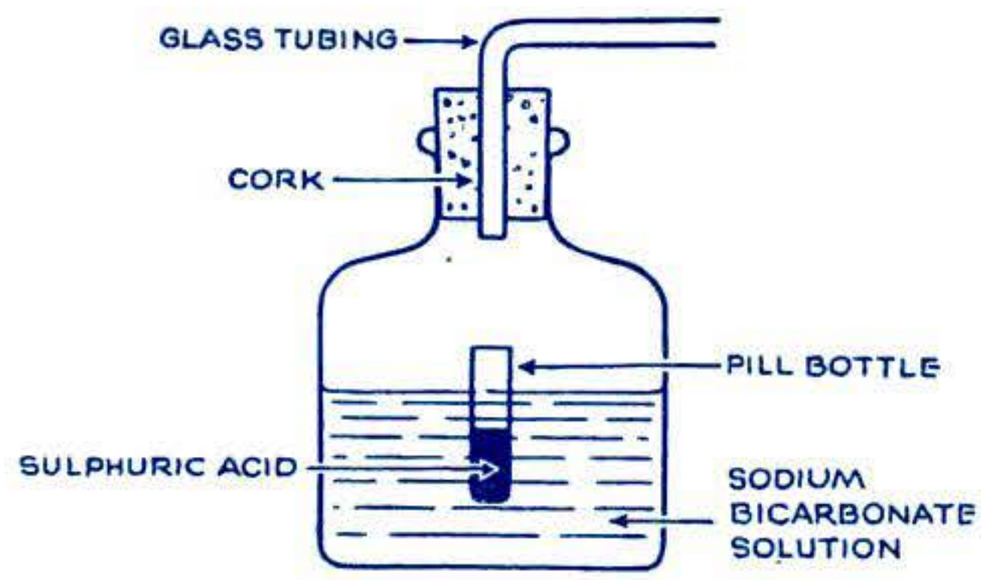
Lift Pump. Backyard wells are often topped off by this useful device. It makes use of atmospheric pressure to lift water from one level to another. How it works can be shown with this model. Burn holes through the cork with a hot wire to allow the water to pass.



Thermostat. When heated, different metals expand at different rates. This principle actuates the common thermostat. Thin sheets of iron and brass riveted together will enable you to show how it works.



Magnetizing Coil. Magnets present a wide field for study. As a beginning, why not make your own? This coil can be used to magnetize knitting needles and other slim ferrous objects.



Fire Extinguisher. You've seen the instructions on fire extinguishers: *turn up to play.* A model extinguisher will help your youngster understand why this is necessary. Don't invert this one, however. Instead, shake the bottle vigorously to mix the sulphuric acid with the sodium bicarbonate solution. This releases carbon dioxide. Be careful not to get any of the acid on your hands or clothing.

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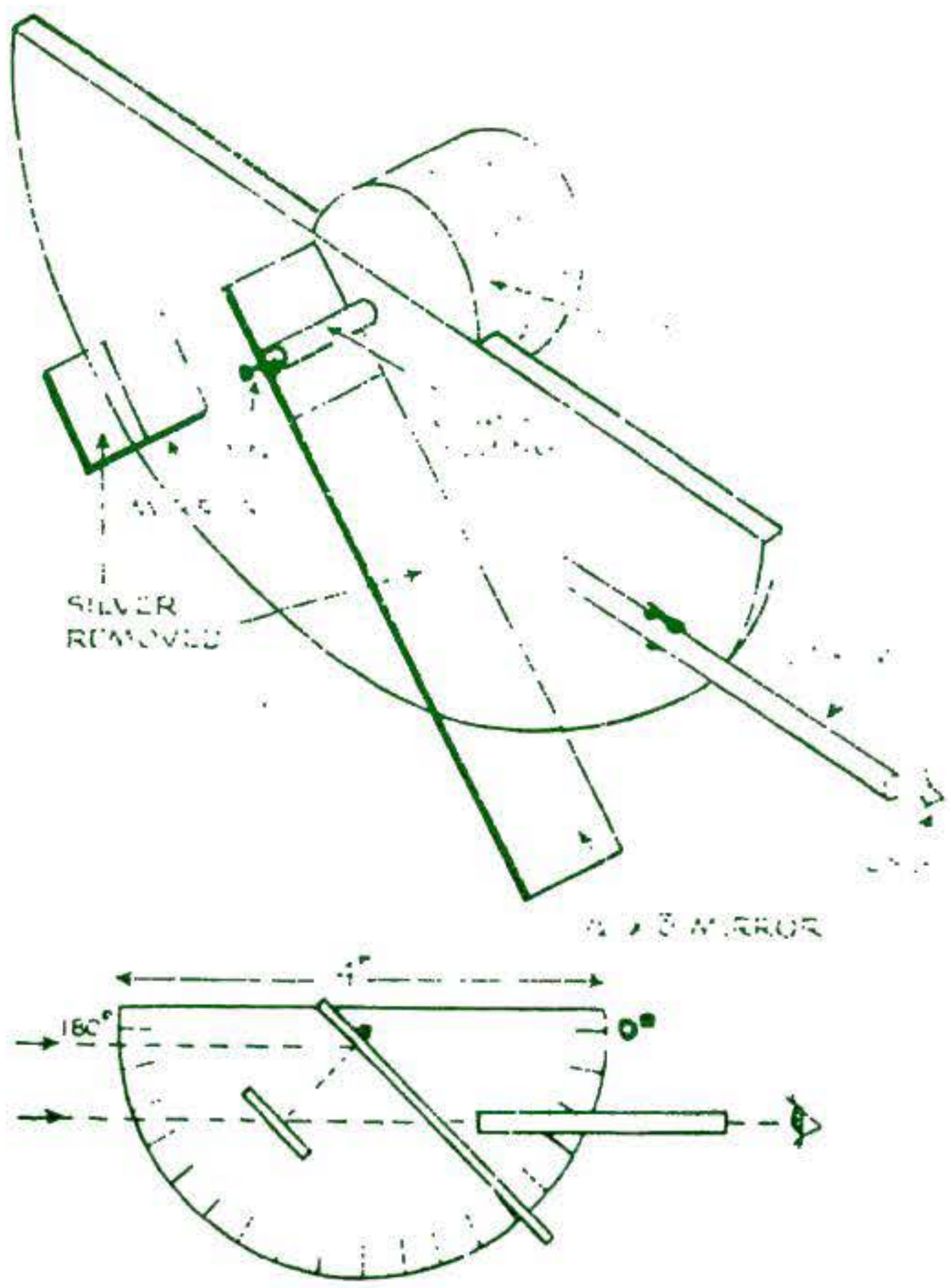


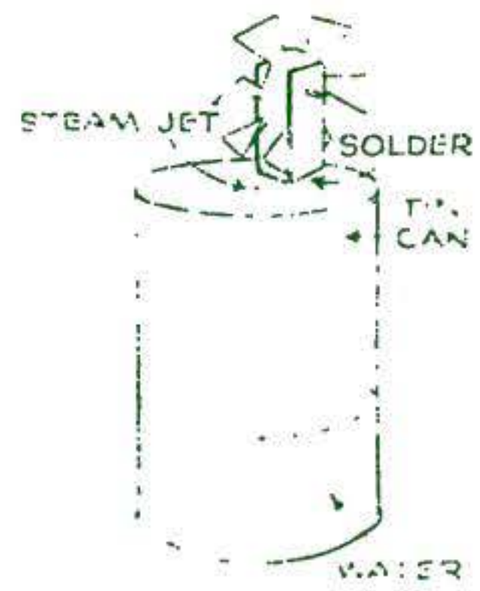
Sextant. Used by navigators to determine the altitude of the sun, this instrument is simple in principle. The graduated arc usually is limited to 60 deg. (Hence, the name sextant.) For convenience, you can use an inexpensive protractor.

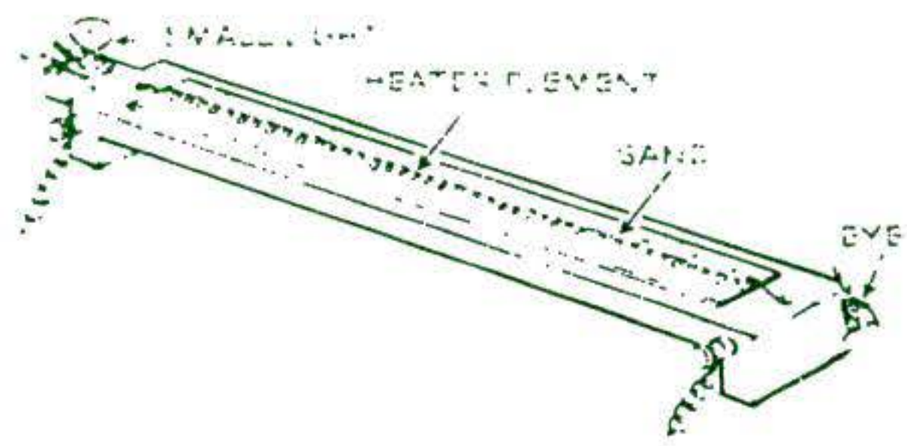
Cut and fit a cork over the edge of the protractor. Stick a heavy pin through the protractor center into the cork. Remove the silvering from all except the first ½″ of the strip of mirror. To the back of this strip, cement a piece of glass tubing that just fits on the pin. Scrape half the silvering from another small piece of mirror and fix it to the protractor at a 45-deg. angle. A drinking straw fastened parallel to the base line of the protractor makes a good sighting tube. It can be cemented in place.

To use your sextant, hold it with the cork in the right hand. Sight toward the horizon, looking through the straw and unsilvered half of the fixed mirror. Then adjust the movable mirror until the two images of the horizon form a continuous line. Record the angle indicated by the glass arm.

Now sight at the sun, using a smoked glass if necessary, and go through the same procedure. Record the angle of the arm. The angle that it has moved is half the altitude of the sun.

Turbine. This comes from a Latin word meaning that which spins or whirls around. Turbines exist in many forms. They're classified chiefly according to the motivating force; that is, water, steam, gas, and so on. You hear much about turbines these days in connection with aircraft propulsion. This model will help you show others the basic idea of how they work.

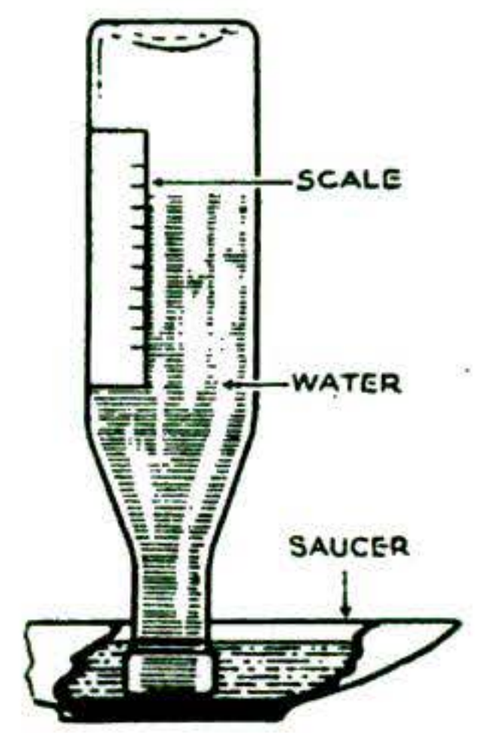




Mirage. This common optical phenomenon of the desert is produced by layers of hot air of varying density. These layers refract, or bend, light rays, enabling you to see objects at quite some distance.

The apparatus shown here will bring a mirage into your own living room. When the element is hot, an eye located in the position shown will see a reflection of the bulb in the hot air above the wire. If you wish, the wire can be completely hidden by burying it in sand, but the apparatus will then take longer to heat up.

Barometer. Probable weather changes are predicted by the use of a barometer. It registers the rise and fall of atmospheric pressure.



Here's a barometer in its simplest form. Partly fill the bottle with water. Invert it with its mouth under the surface of more water in a saucer. Approximate variations in atmospheric pressure can be noted by cementing a graduated strip of paper on the outside of the bottle.

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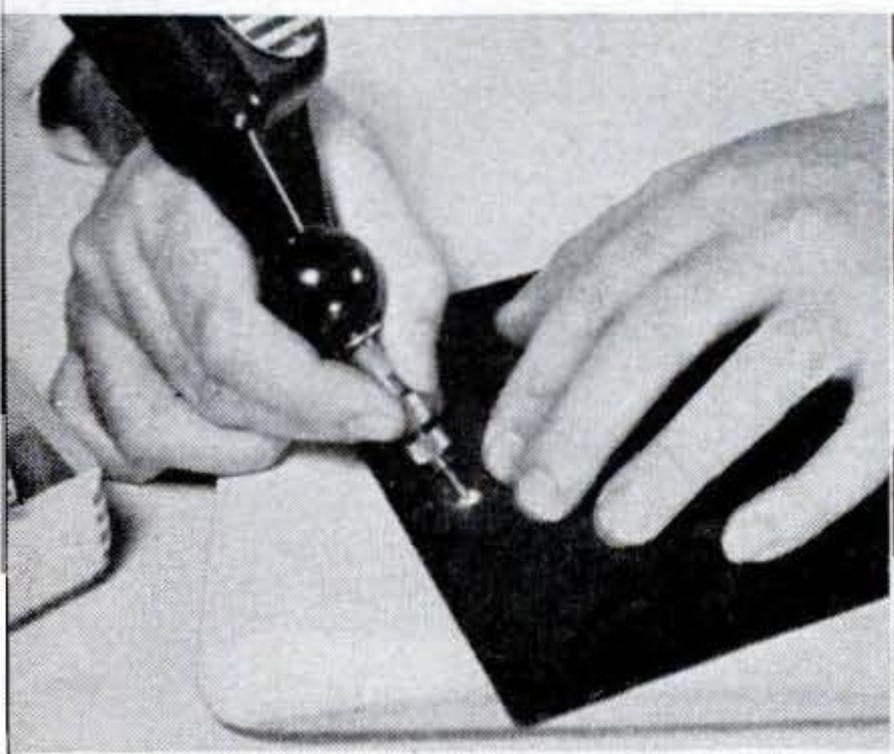
Four Ways to Drill Glass

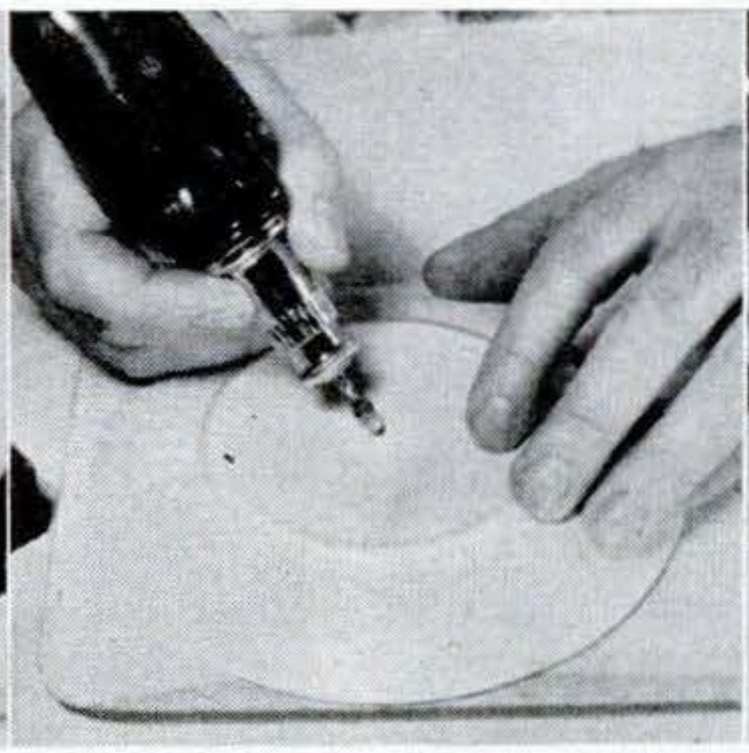
Converting a vase or bottle into a lamp or drilling a mirror for hanging is a lot easier if you use the right tools for the work. At right a sheet of glass is drilled with a small three-cornered file.

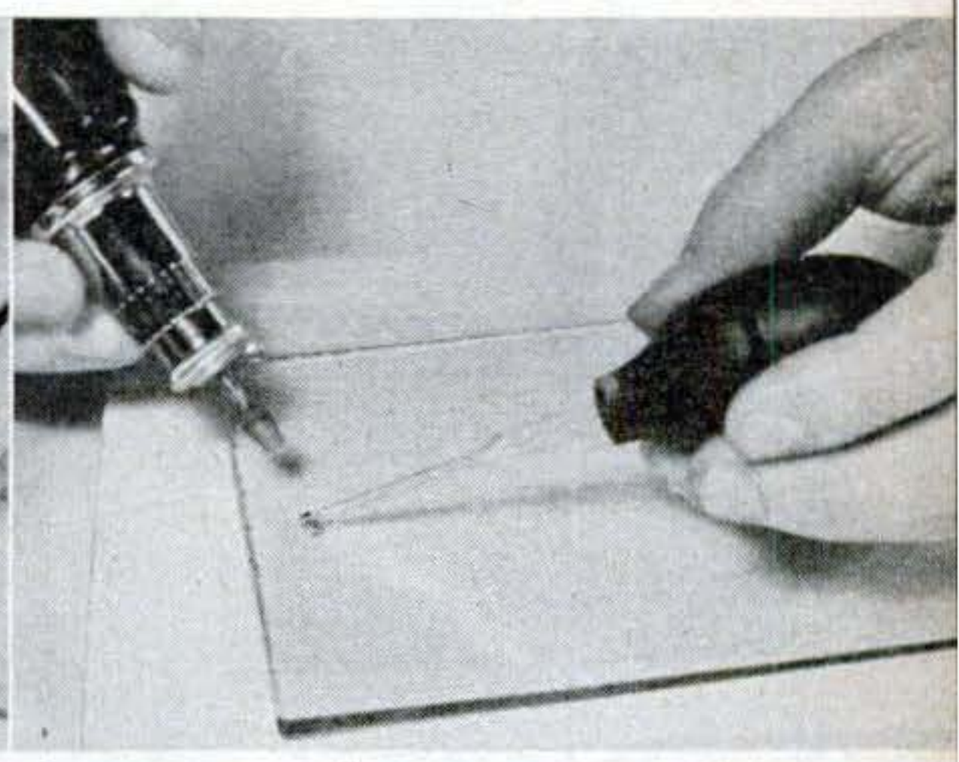
DRILLING glass or ceramics is never a cinch, but you can ease the job and keep down breakage by following the proper procedures. Of course, you can buy special bits for the purpose, but if the job turns up only occasionally, most craftsmen can get by nicely with the usual tools.

An electric vibrating or engraving tool with a diamond-point bit will drill glass but it takes a little time and patience. Don't try to use this tool on glass that's thicker than ¼″ or so. It may take from 20 to 30 minutes to put a hole in a 3/16″ piece. Use a circular motion. Don't bear down too hard on the work. Let the tool do the cutting. Guide the point in small circles first and then cut back and forth across the circle, but always return to the circular motion. Keep the sides of the hole straight or you'll find it shrinking to pin-point size. A diameter of ⅛″ to 3/16″ is minimum. Work the job from both sides, if you can.

The small electric hand grinders or a flexible shaft tool also will drill glass when







Three photos above show a mirror, china plate, and a pane of glass being worked. At left, an electric vibrating tool with a diamond-point bit is used to drill a mirror for hanging. Center photo shows a plate being drilled with a cone-shaped abrasive point chucked in an electric hand grinder. Plate was used in a two-tiered pastry server. A hole was needed in the pane of glass at right to pass through a radio lead-in wire. Electric hand grinder with an abrasive point was used. The dropper feeds turpentine to the point to lubricate it.

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Brass tubing and electric drill cut a hole in a glass bottle to wire it as a lamp. Putty dam around the drill holds a mixture of turpentine and abrasive powder to speed cutting.

fitted with a cone-shaped abrasive point. Lubricate the work with a little turpentine. Don't work the drill continuously. Keep the wheel running but only bear down on the glass at short intervals. Once the hole has been made, it can be enlarged by grinding away the glass around the sides.

You can also drill glass with an old three-cornered file chucked in a hand or electric drill or in a brace. Use a short file and lubricate the work with turpentine. Break off a bit of the end of the file if it rounds and softens under friction.

Then there's the old stand-by—a piece of brass tubing used in place of a bit to drill ceramics or glass. Pick a tubing that's the same outside diameter as the hole you want. Notch the drilling end of the tube with a file. Build a putty or modeling-clay dam around the spot where you'll drill and put a mixture of turpentine and abrasive powder in the dam. As the work goes along, the heat of the drilling will evaporate the turpentine. Add a little more from time to time,

If you plan to do a lot of drilling on glass or ceramics, buy one of the special drills.—*Arthur Miller, Manhattan, N. Y.*

Notch the brass tubing with a file. It speeds up the drilling. When using this method, select tubing that's the same diameter as the hole you want in the glass or ceramic.

You can drill ceramics faster since they're a lot softer than glass. Above, a vase is drilled with brass tubing to convert it into a lamp. Use turpentine and abrasive powder.

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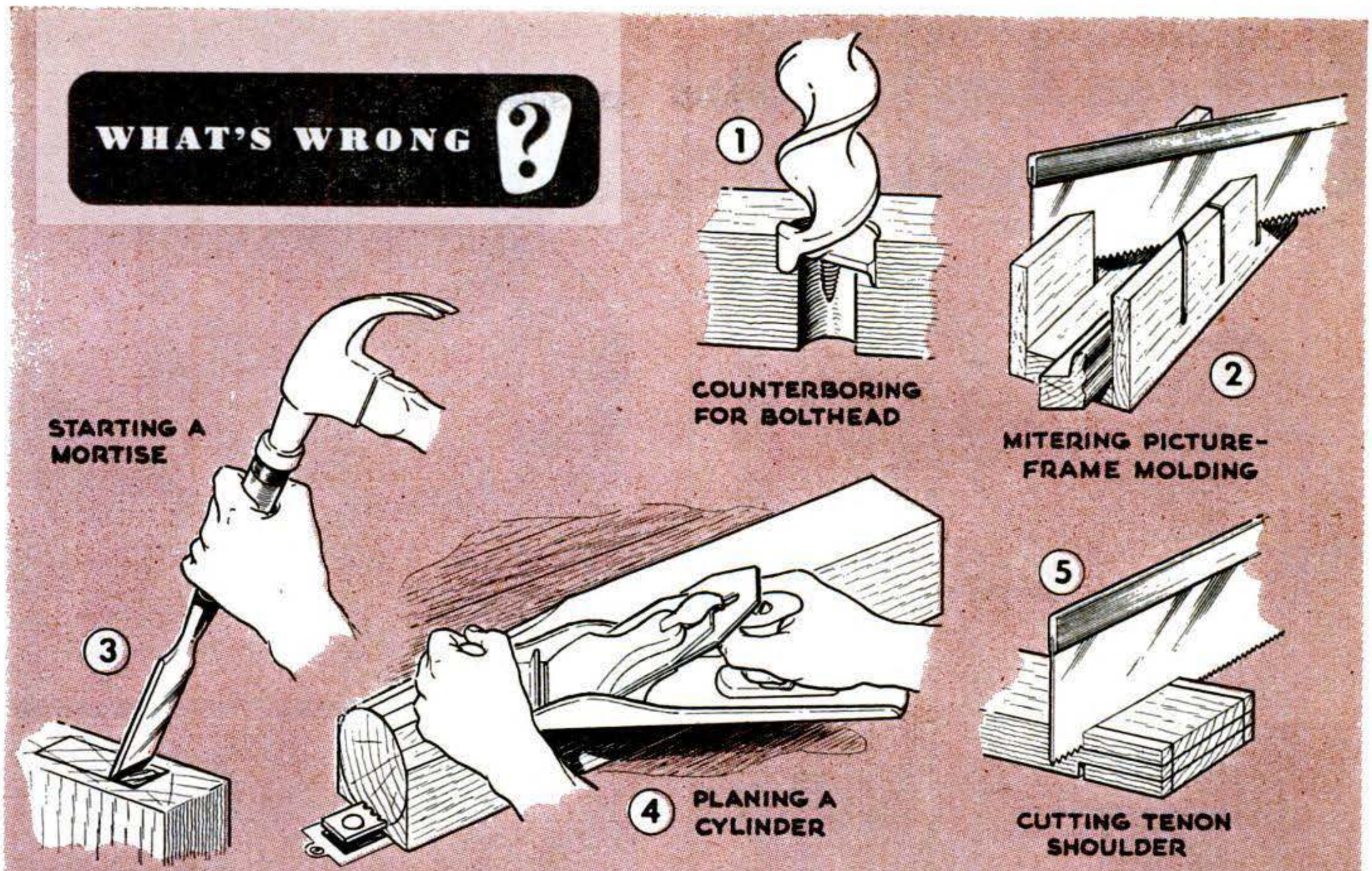
WHAT'S WRONG ?



WOODWORKING technique isn't just a set of rules invented by the experts in order to make things tough. There's a reason for practically every "right" and "wrong" way. Usually the right way prevents damage to the work or the tools, and does the job better. See if you can spot the errors shown here.

Answers

1. When the smaller hole is bored first, the bit has no center and may tear or scar the wood. The forsighted craftsman counterbores first. If this isn't possible, use a dowel centering plug on the bit.

2. The back saw cuts on the push stroke, so hold the work against the far edge of the miter box. Wherever possible a true rather than a molded edge should bear against the wall. Sawing the second miter parallel to the first will make it impossible to put the frame together. Reverse the angle of cut.

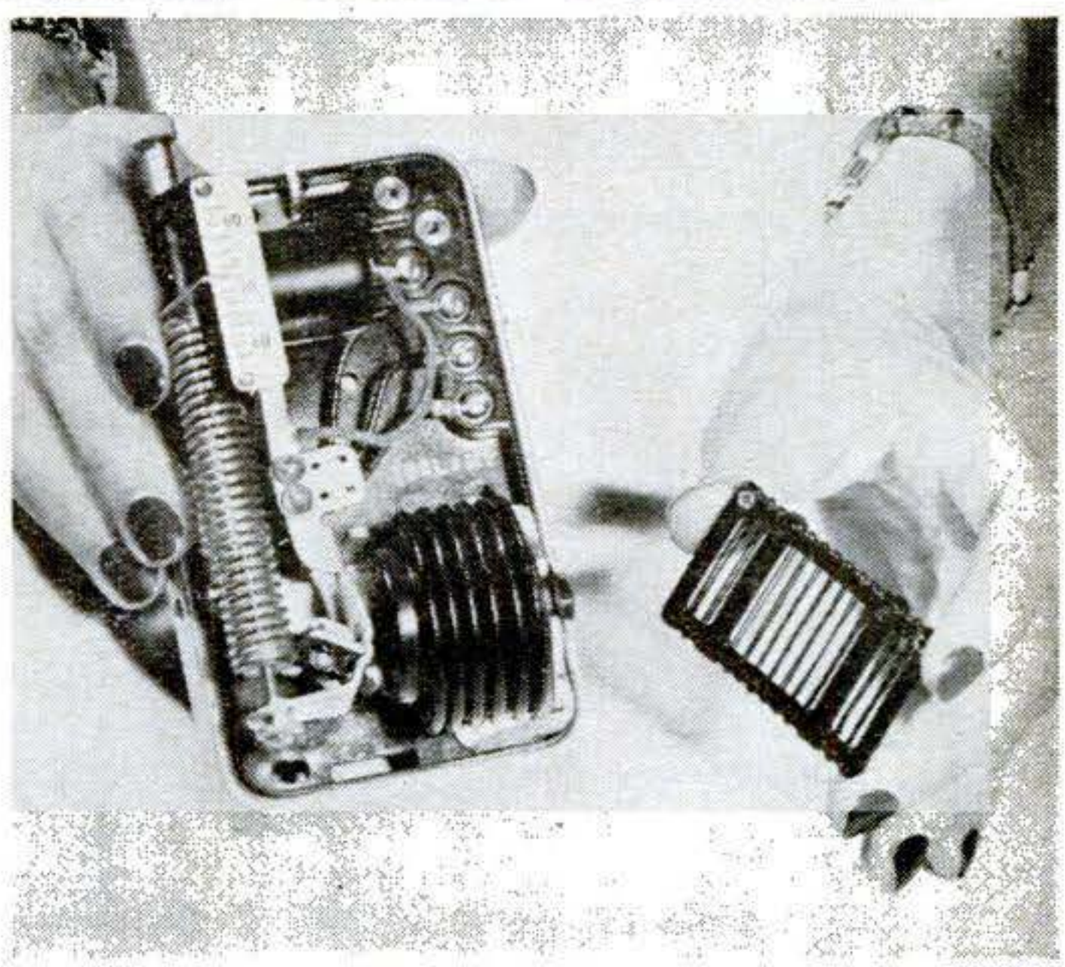
3. What happened to the mallet? If you don't have one, the side of the hammer head may be less likely to damage the chisel handle.

4. For evenness in rounding rectangular work, plane the full length into an octagon and keep cutting down the corners. Bring the entire plane sole into contact with the work.

5. Cheek cuts are always made first. This allows the waste to support the saw so there's less danger of cutting into the tenon.

Amplifiers Make Thermostats More Sensitive

A NEW control system for air conditioners developed by Minneapolis-Honeywell Regulator Co. is said to be about 100 times as sensitive as previous controls. The tiny plastic frame at the right, wound with 51 turns of wire, replaces the larger mechanical thermostat pictured with it. Very slight temperature changes produce changes in the electrical resistance of the wire. Fed through sensitive electronic amplifiers, these changes govern the control motors which, in turn, operate the valves and dampers of the heating or air-conditioning system. Additional thermostats may be added to average the temperature of a large area or compensate for changes in outdoor weather.



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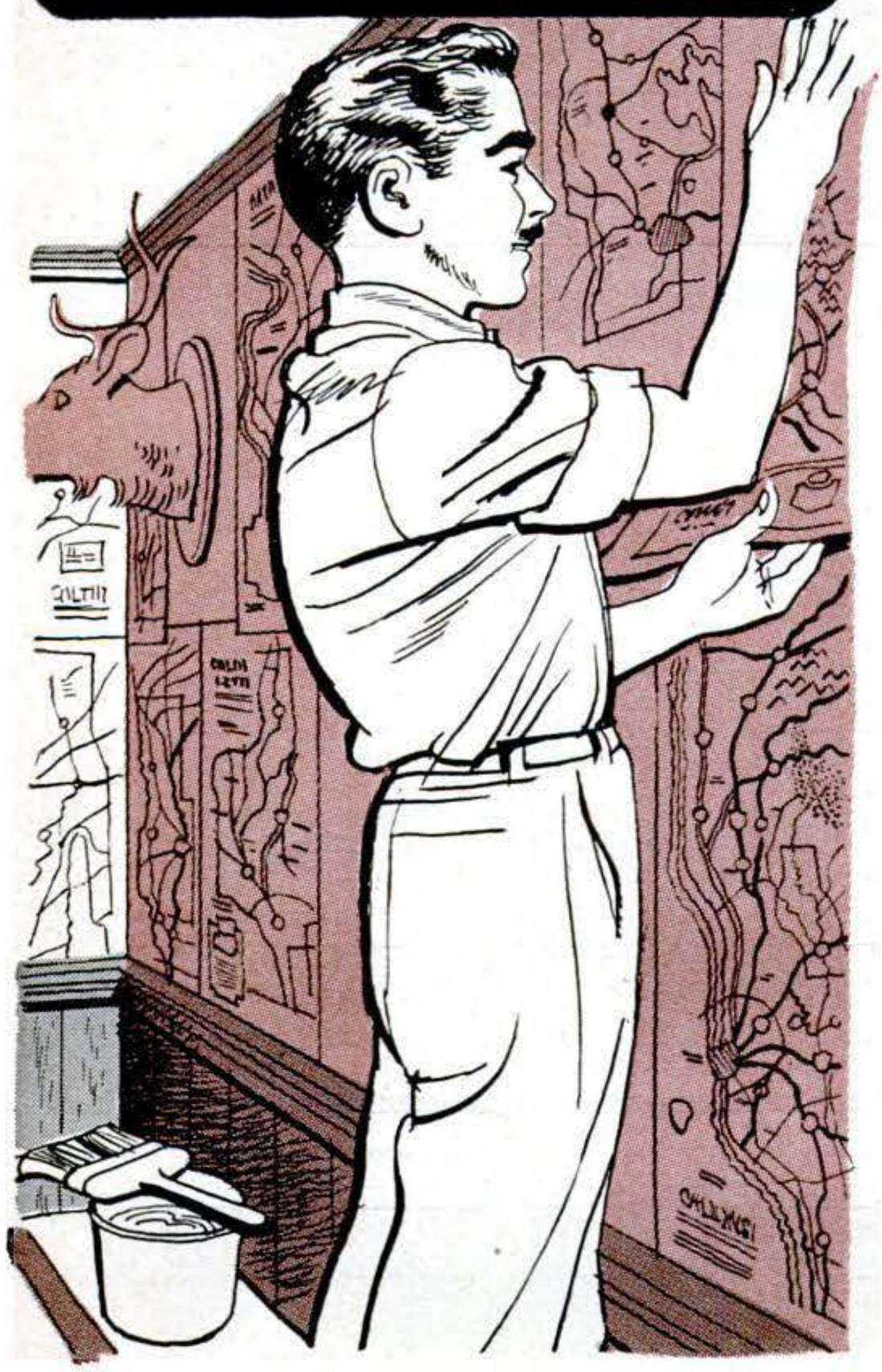
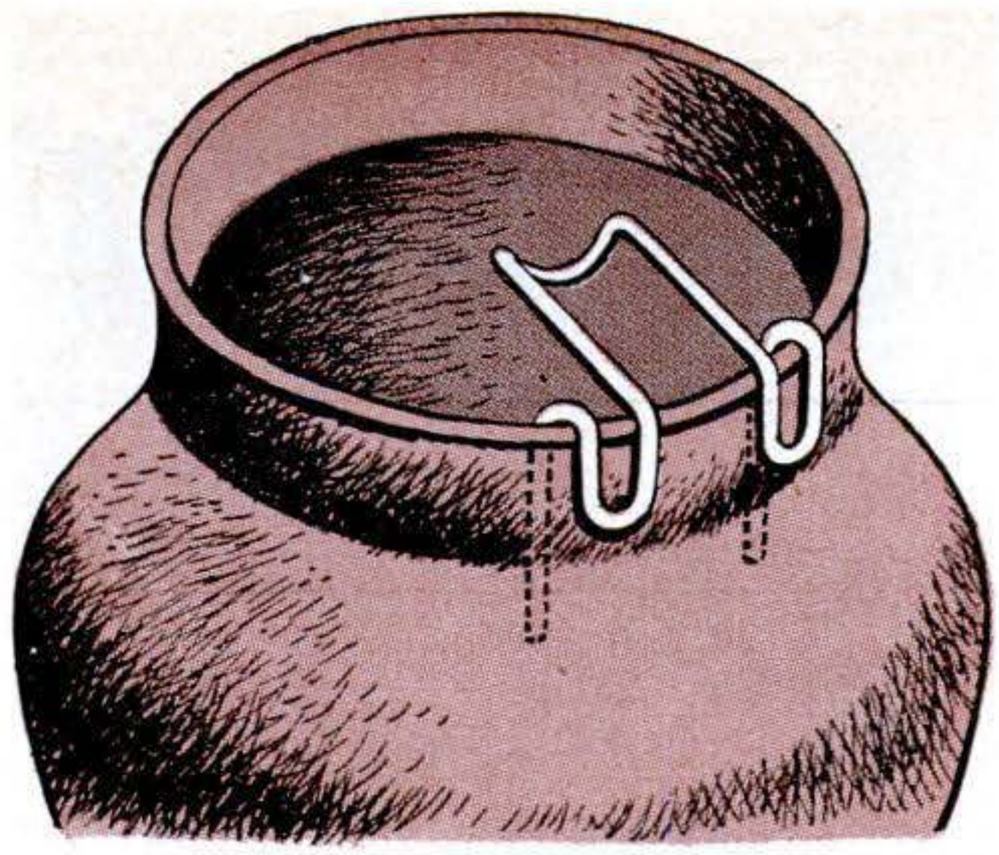
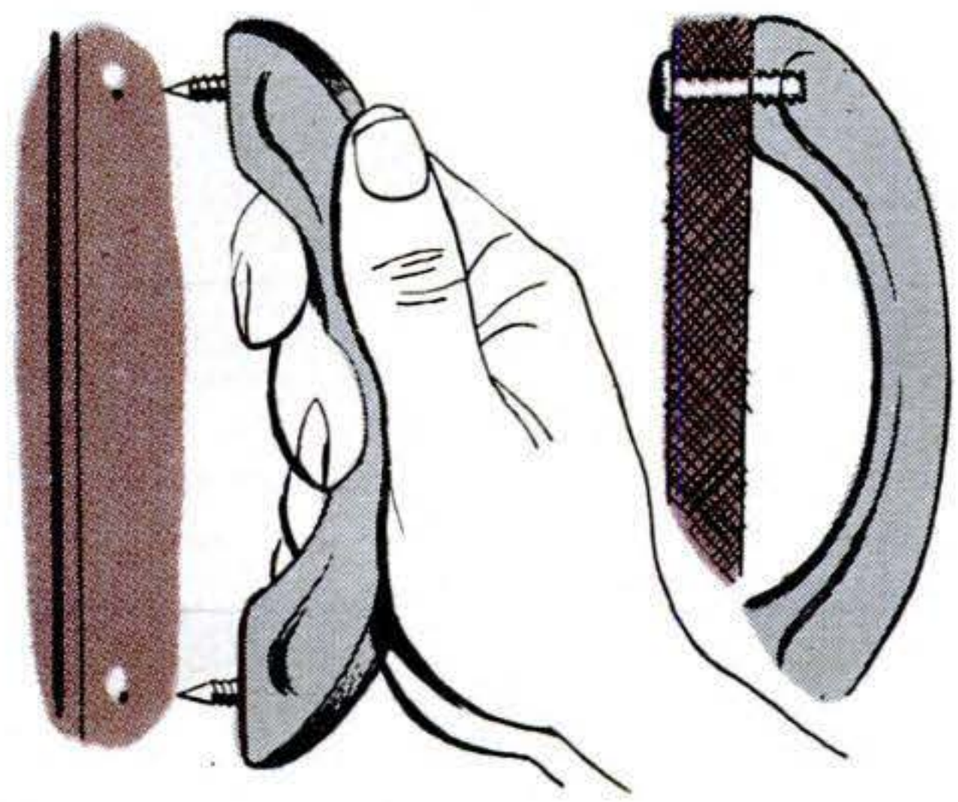
Keeping the Home Shipshape



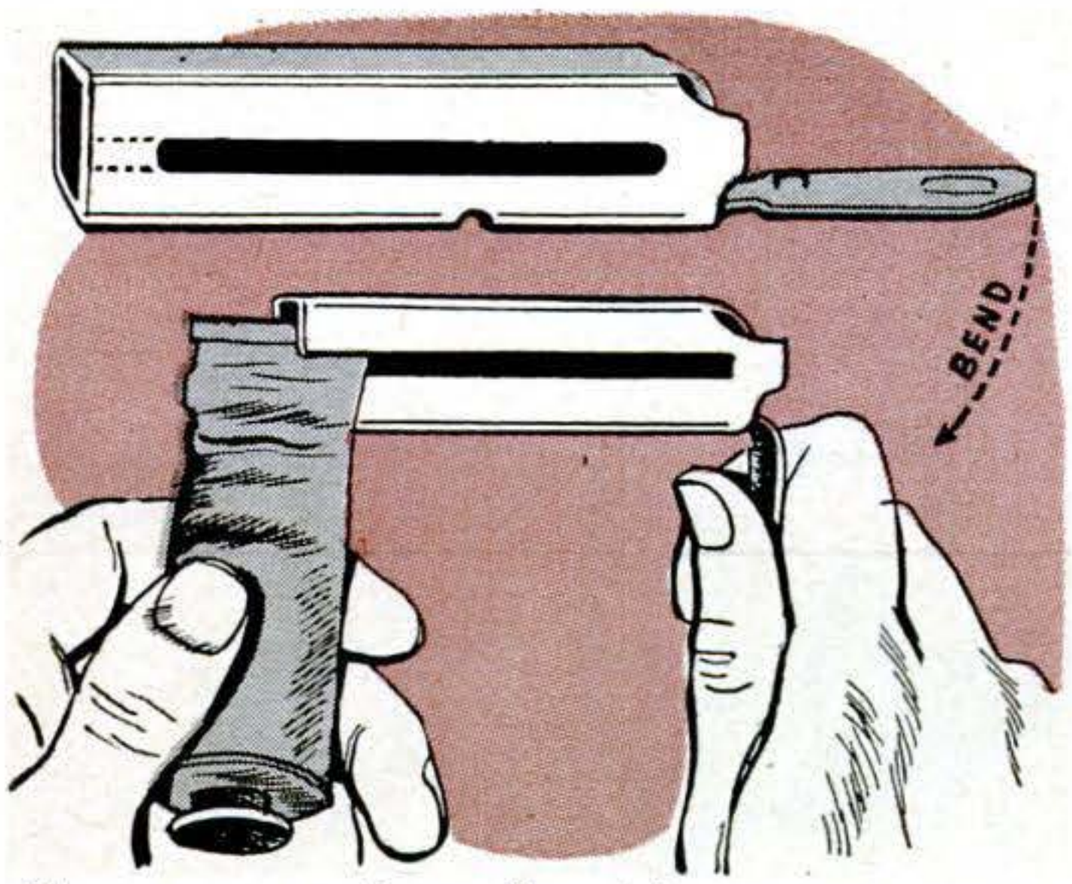
Road maps make fine, inexpensive wallpaper for a game room, attic, basement, or den. Trim the borders, apply the sheets with wallpaper paste, and coat them with clear shellac.



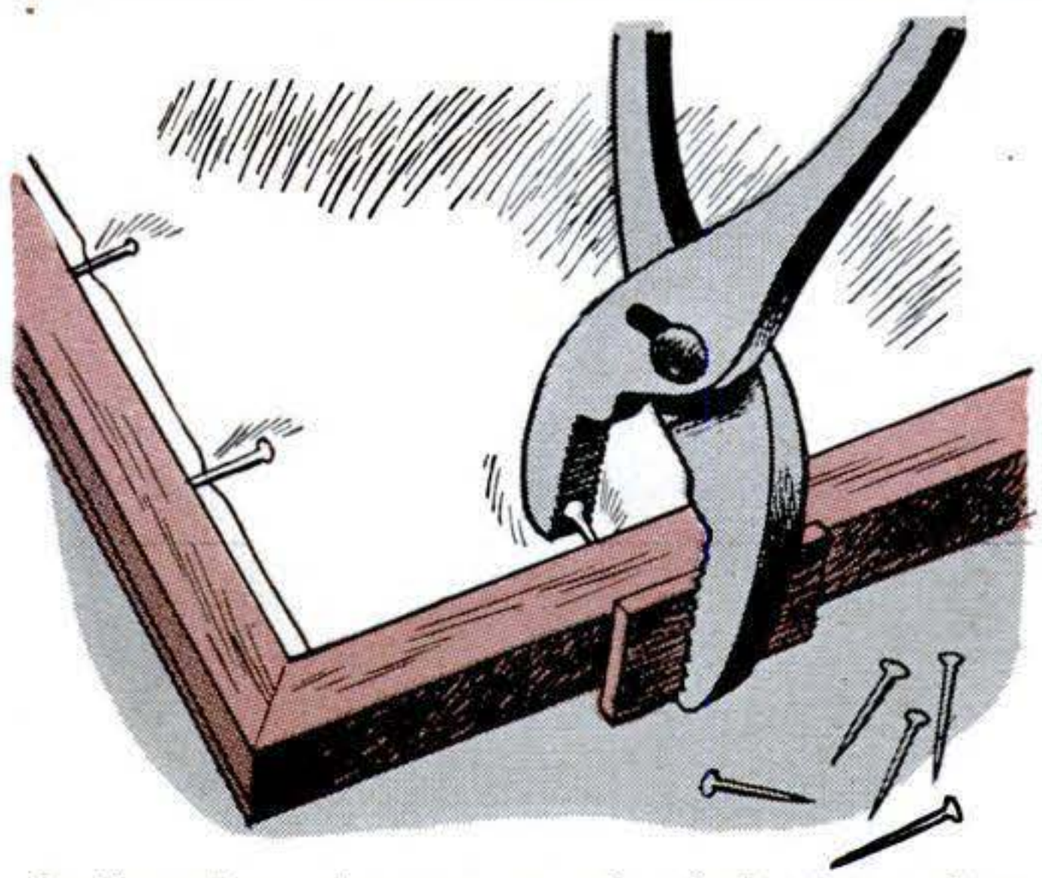
A safe ashtray for desk or shop can be made from any large-mouth jug. Bend a piece of stiff wire as shown. Then if a cigar or cigarette is neglected, it will ultimately fall inside.



Drawer pulls will serve as their own marking templates if you make two special screws. Grind the heads to points, turn them lightly into the pull, and press them into the face.



Empty magazines for injector-type razor blades help in squeezing shaving-cream tubes. Remove the clip and slip the tube in. For larger tubes, cut the slot open to the end.



In framing pictures, a pair of slip-joint pliers is handy for driving the brads or glaziers' points that hold the picture and mat in place. Use a backing block to protect the frame.

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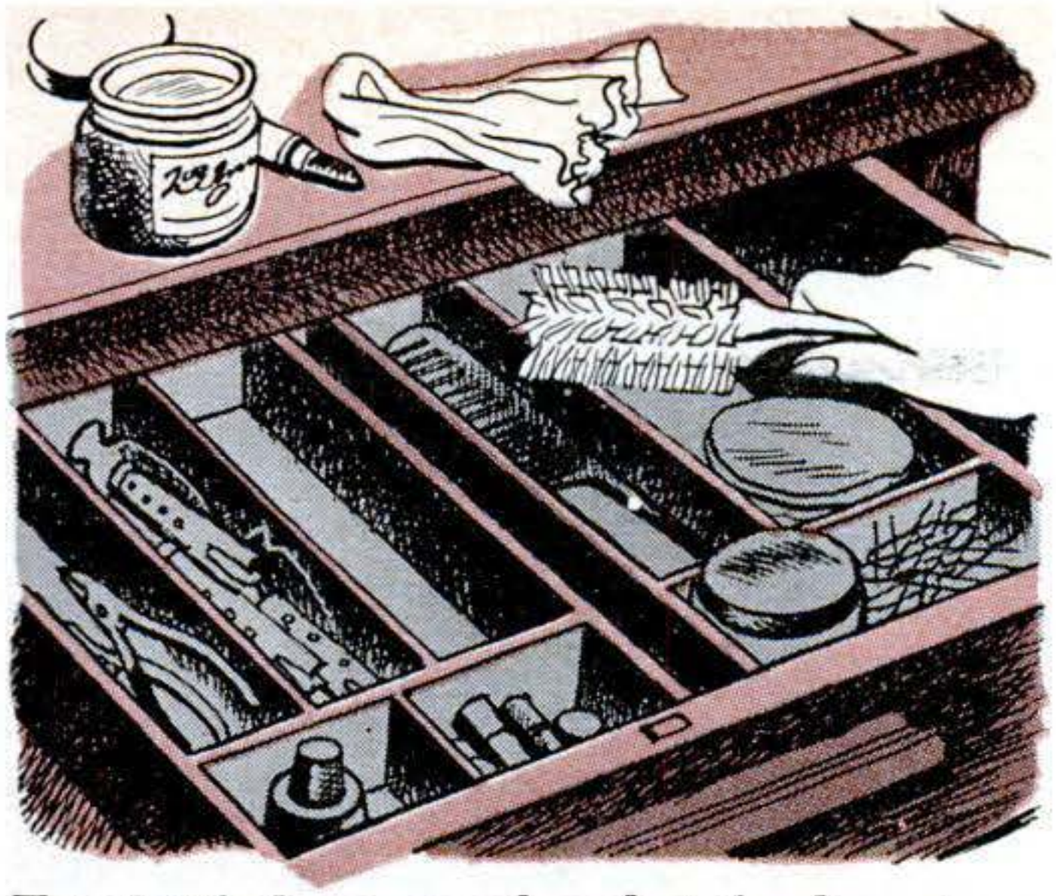
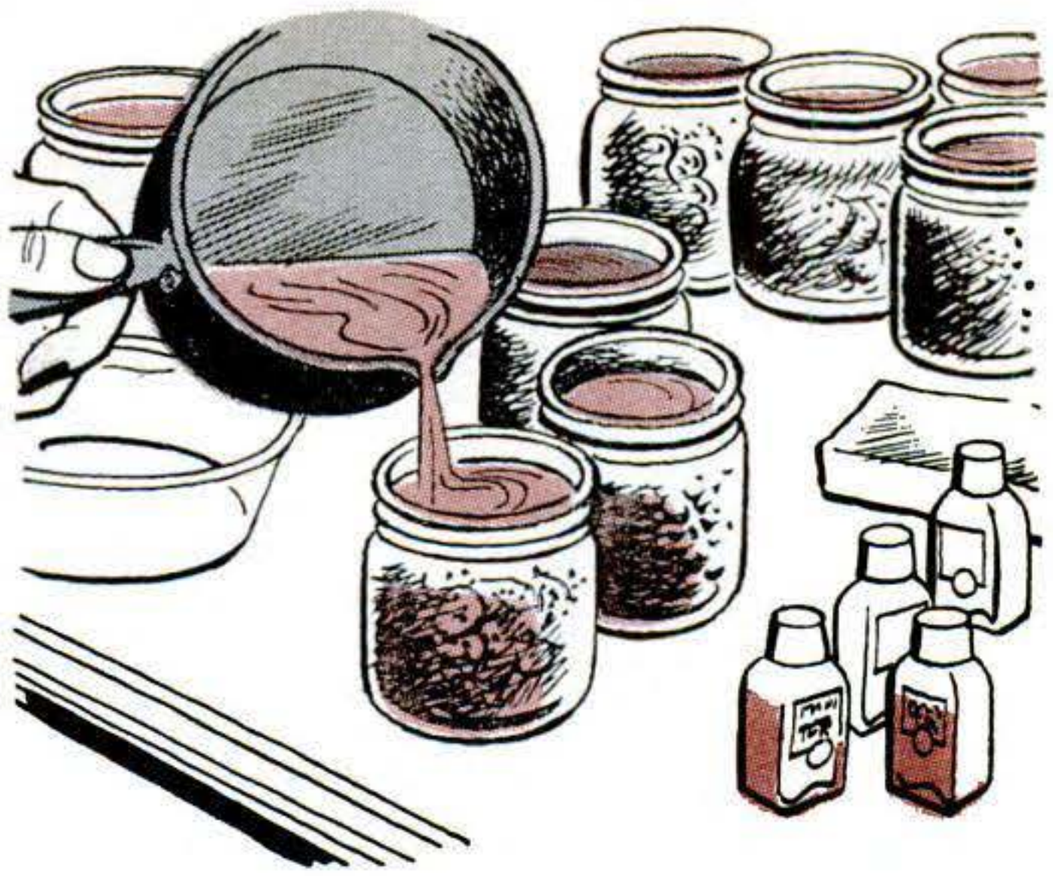
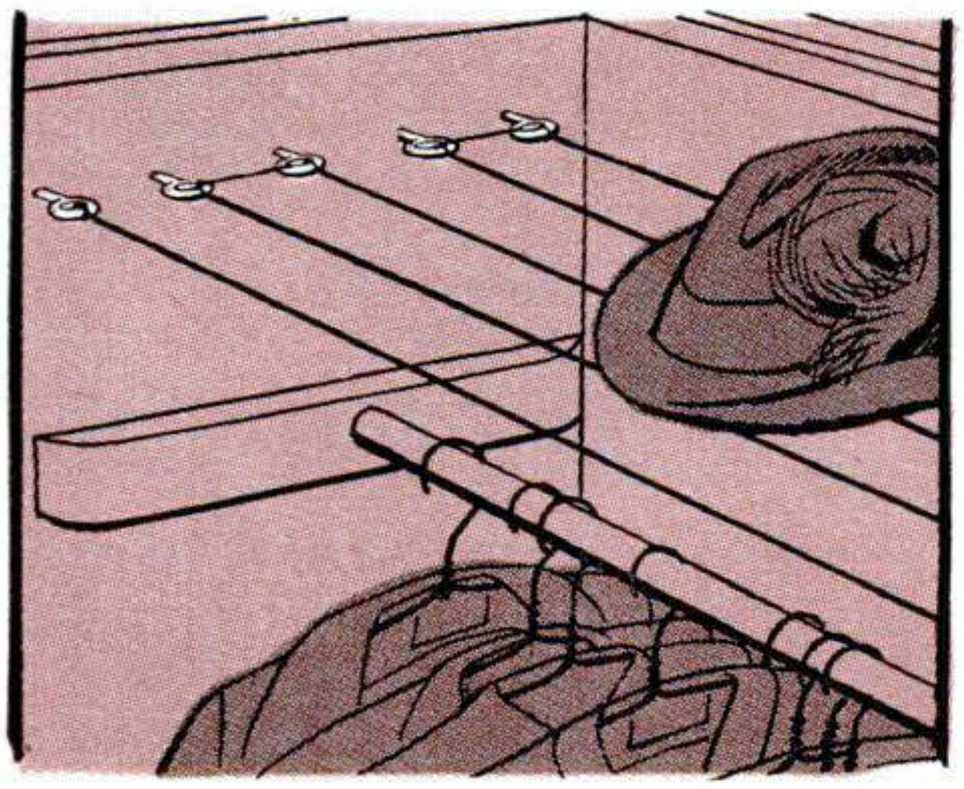


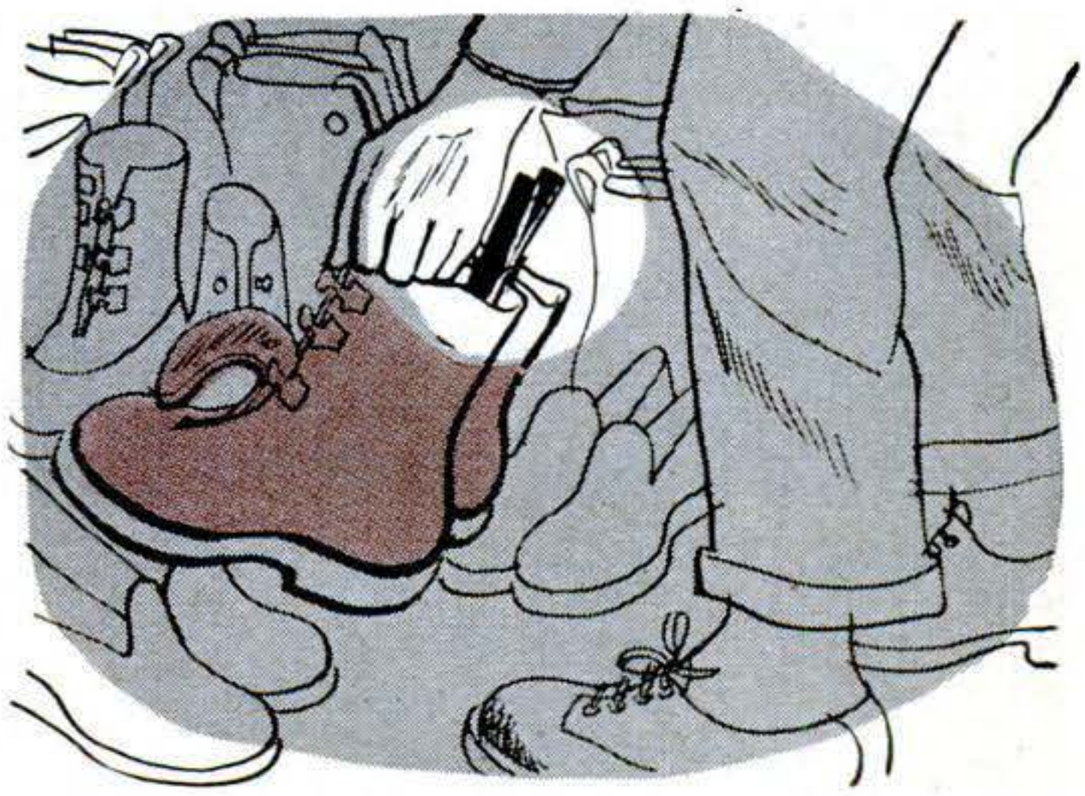
Two knife boxes purchased at the dime store will keep dressing-table supplies in order. Bolt the boxes together or screw them to a common base. Add extra partitions if needed.



To identify your preserves at a glance, add a small amount of vegetable coloring to the hot paraffin used in sealing the jars. You can also key the colors for date of canning.



An additional shelf for hats or similar light articles can be easily made by lacing four or five rows of heavy twine tightly through screw eyes set in the sides of a closet.



Let your child carry an initialed, spring-type clothespin to school with him. When he takes off his rubbers or galoshes, he can clip them together and locate them easily.

Appropriate tie-backs for kitchen curtains can be made from such inexpensive utensils as pancake turners, spoons, or forks. Drill each handle for a screw and bend it into a flat U shape.

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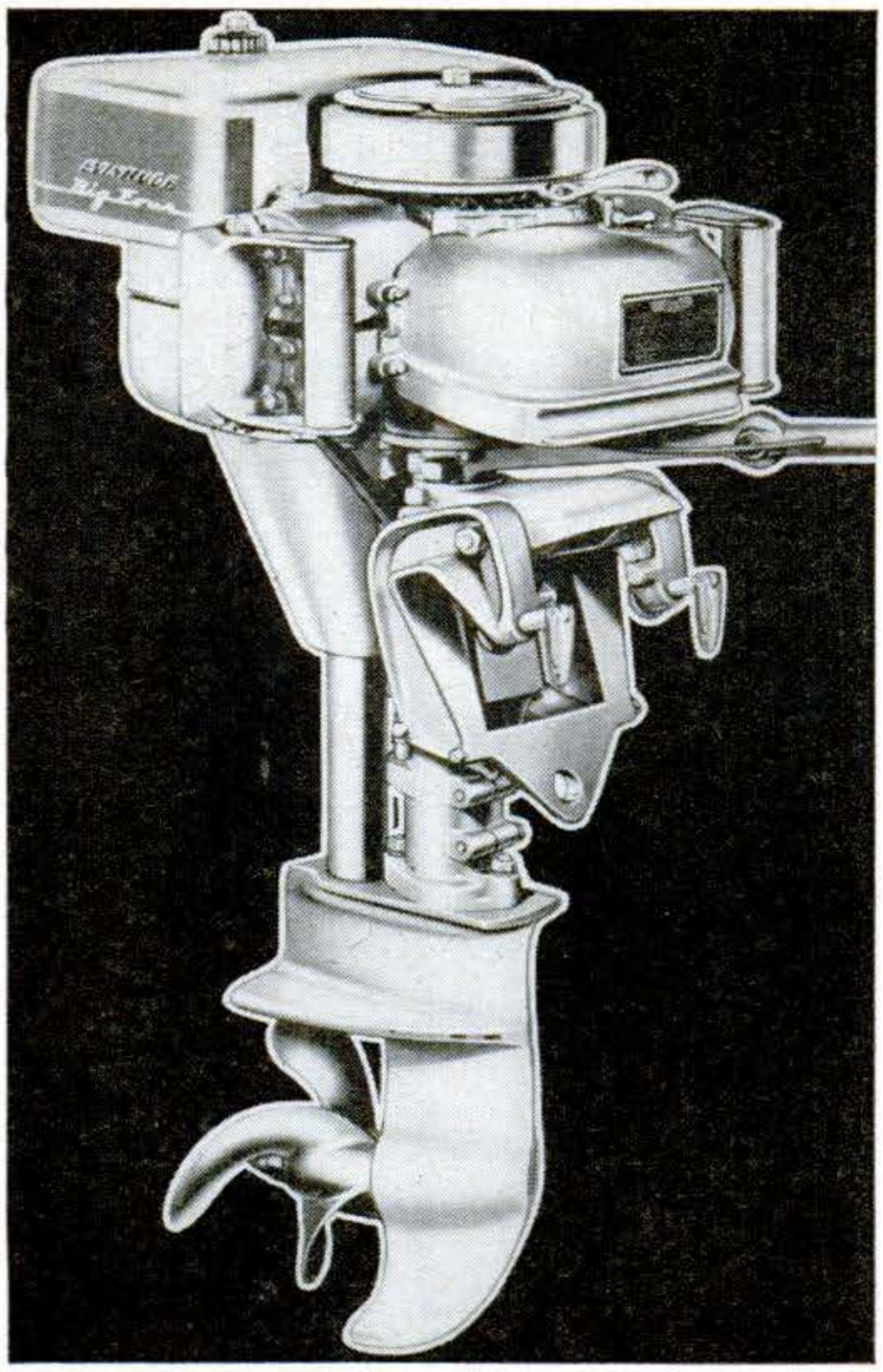


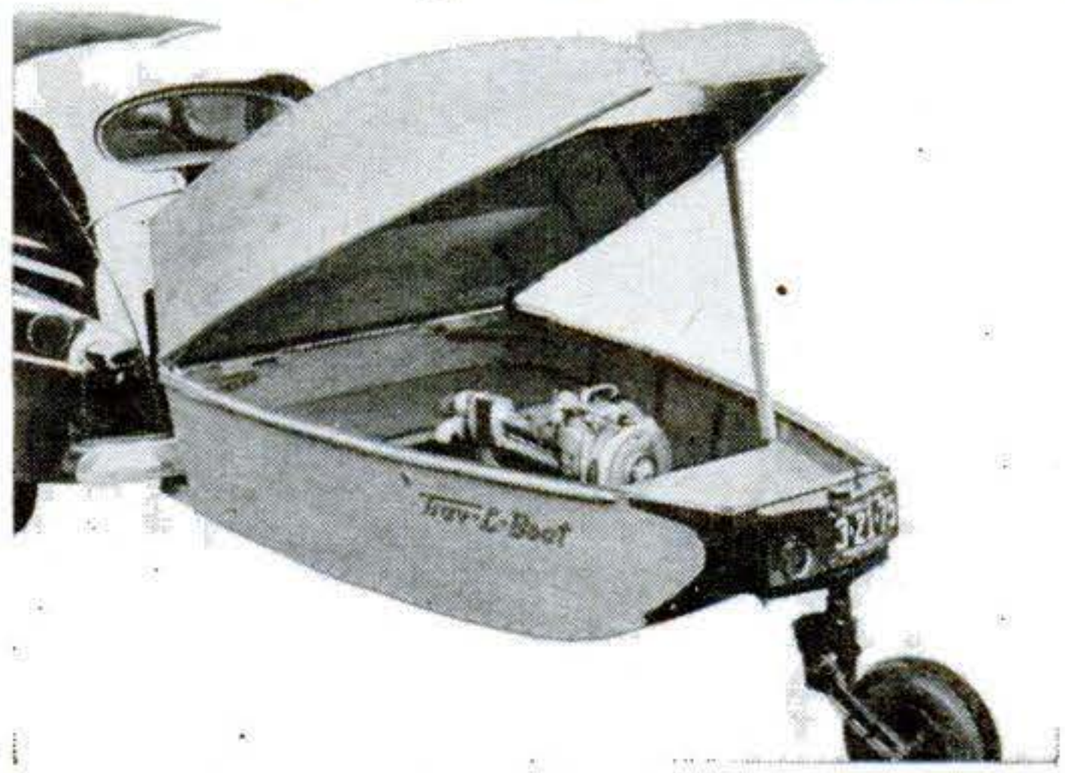
50-Hp. Motors Made Again

EVINRUDE Motors, Milwaukee, Wis., has resumed limited production of the Big Four ®, suspended in 1947 because of material shortages. Rated at 50 hp. at 5,000 r.p.m., the Big Four is a development of the motors used by the Army on heavy landing barges to carry combat troops and equipment across the Rhine. The motor delivers speeds up to 45 m.p.h. on large runabouts. It also is used as a heavy-duty workboat motor. Timken ® bearings are used in the gear housing.

Cruiser Uses Outboard Motor

THOUGH only 15′ long, this light cruiser sleeps two persons. The cabin floor board can be raised onto two runners level with the seats. This turns the cabin into a 4′10″ by 6′ berth. Cockpit cushions fit between seat cushions to form a mattress. Made by Orono Boat Works, Inc., Wayzata, Minn., it has a 6′4″ beam and a 6″ draft with motor tilted. The hull is double planked with treated canvas laid between the two skins. The boat is priced about $1,500 complete except motor.

Trailer Splits to Form One or Two Boats



ACCORDING to the Barden and Robeson Corp., Lockport, N. Y., the builder, the Trav-L-Boat ® can be floated as one 14′ boat, separated into two 7′ boats, used as a trailer, or as a 7′ undercover sleeping compartment. As a boat or boats, each part may be powered by an outboard motor or oars. Used as a 14′ craft, it has a 48″ bottom beam and an 18″ depth at center. It seats up to six persons. A 5-hp. outboard cruises it about 10 m.p.h. Built of marine plywood, it has disconnectable hinges on each gunwale that are self-locking.

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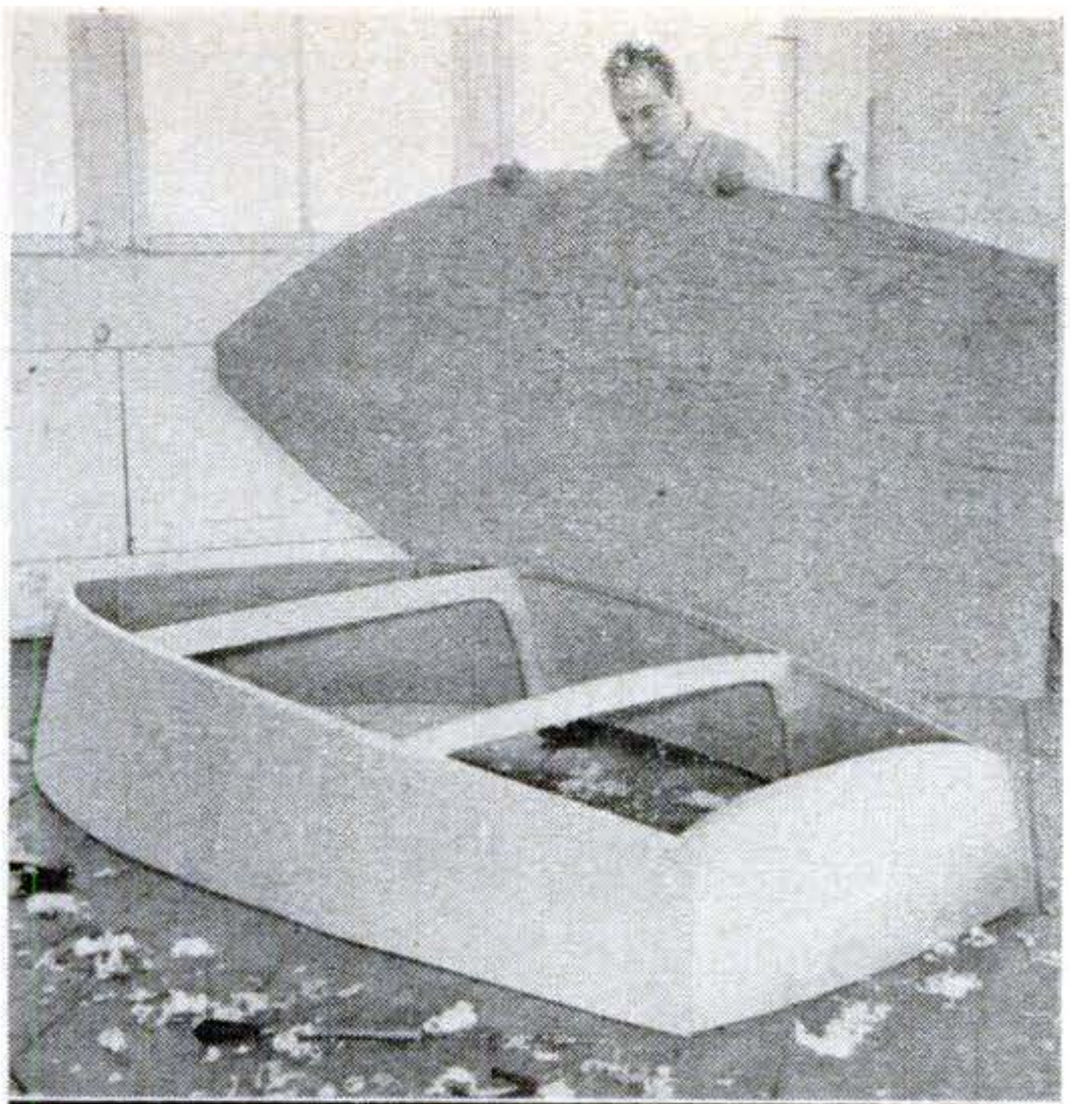
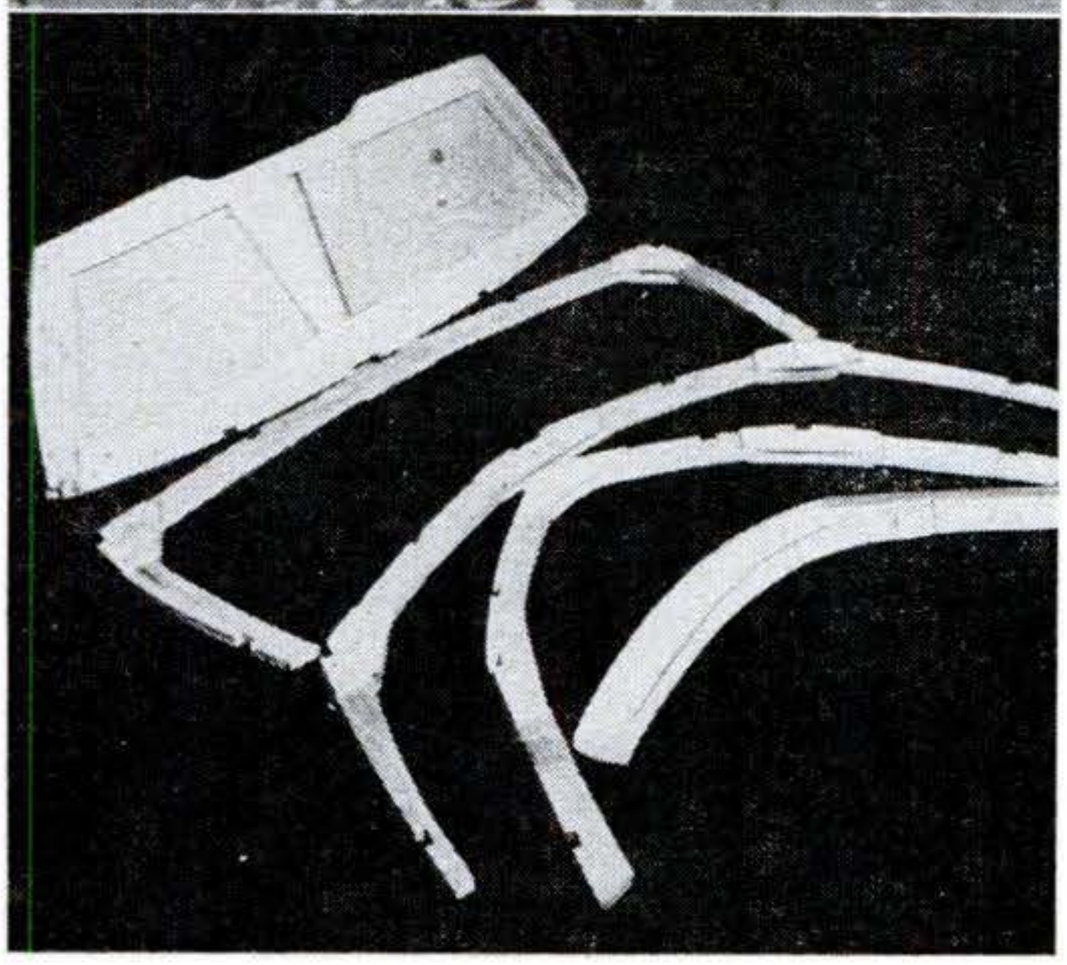


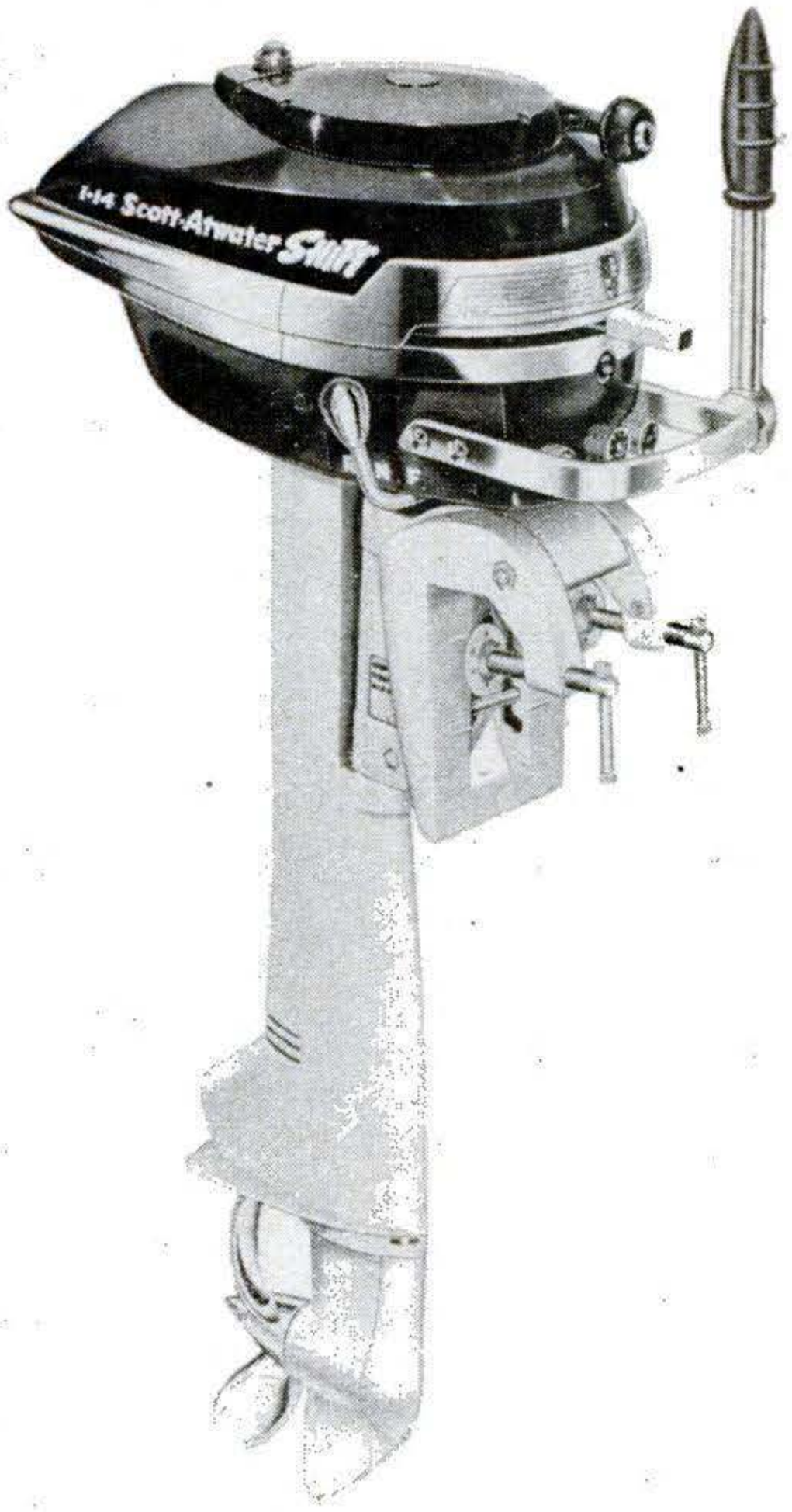


New Packaged Boats Offered

EACH of the 18 packaged boat models—from 8′ to 18′ long—offered by the Buffalo Marine and Sports Mart, Inc., of Buffalo, N. Y., comes complete except for paint and deck hardware. Only one model, an 8′ pram, requires a building jig and that is included in the kit. The company also sells marine accessories and boat patterns.

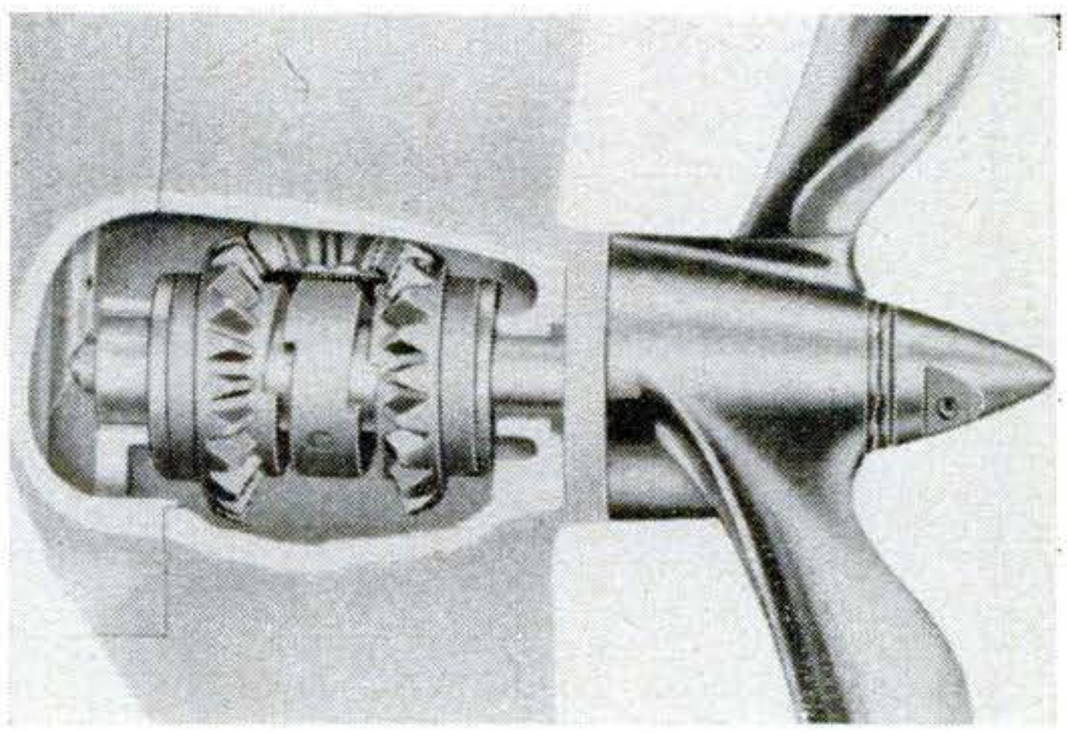
The top photo shows a one-piece plywood bottom ready to be installed. Lower photo shows another model's preassembled parts—transom, frames, and steam-bent stem with the keel attached. Completed subassemblies save about 50 percent in construction time, according to the manufacturer.

One model, a 12′ skiff, for oars or outboard motor, has been designed for the completely inexperienced amateur. The transverse and longitudinal members are notched so the framework locks together, aiding assembly.



Outboard Motor Reverses

THE gear on the vertical drive shaft of the new motors built by Scott-Atwater Manufacturing Co., Minneapolis, Minn., is always engaged with both forward and reverse gears. A dog clutch on the propeller shaft is shifted to engage either one or is left in neutral. The three models with the gear shift retail at less than $200.



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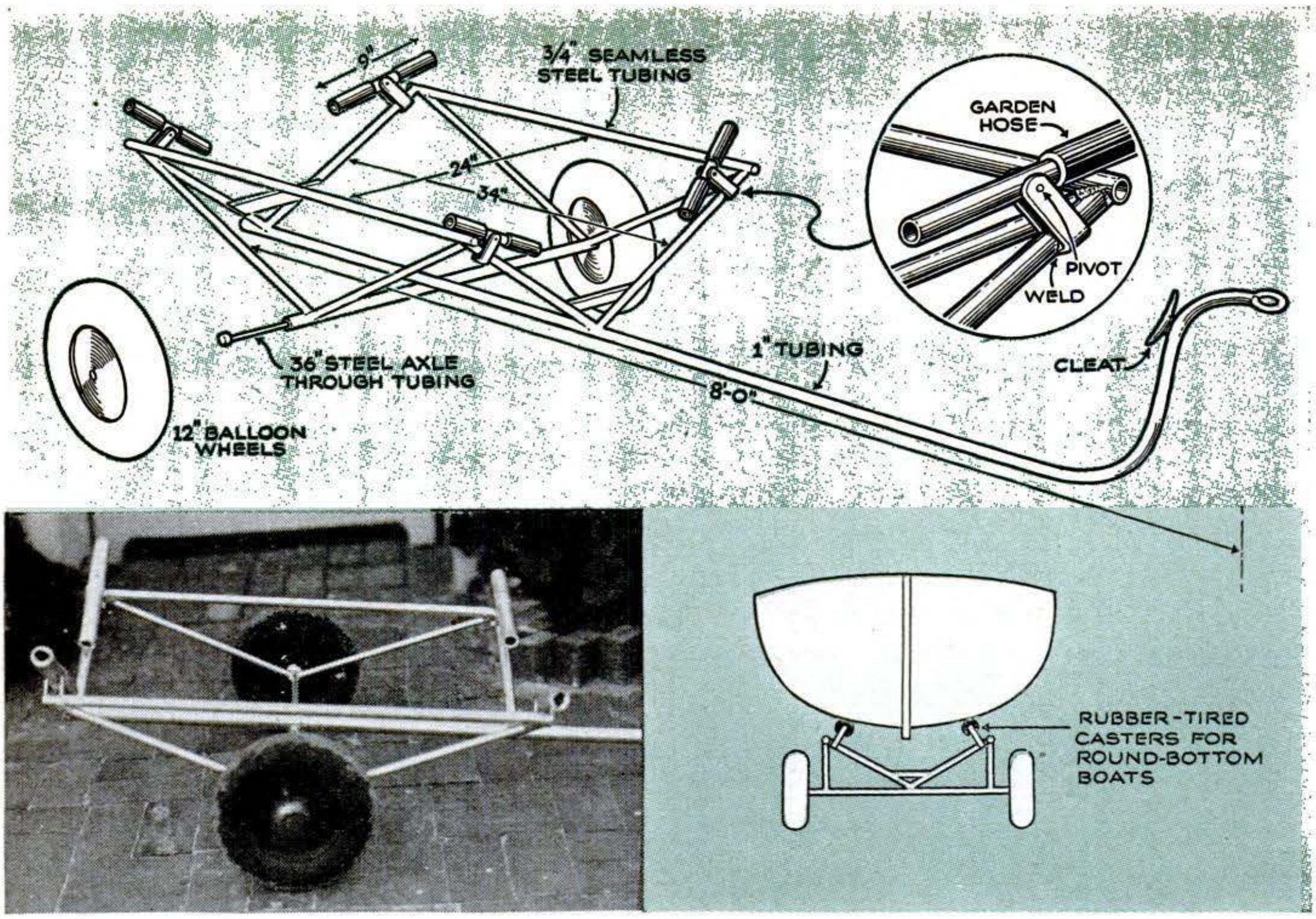
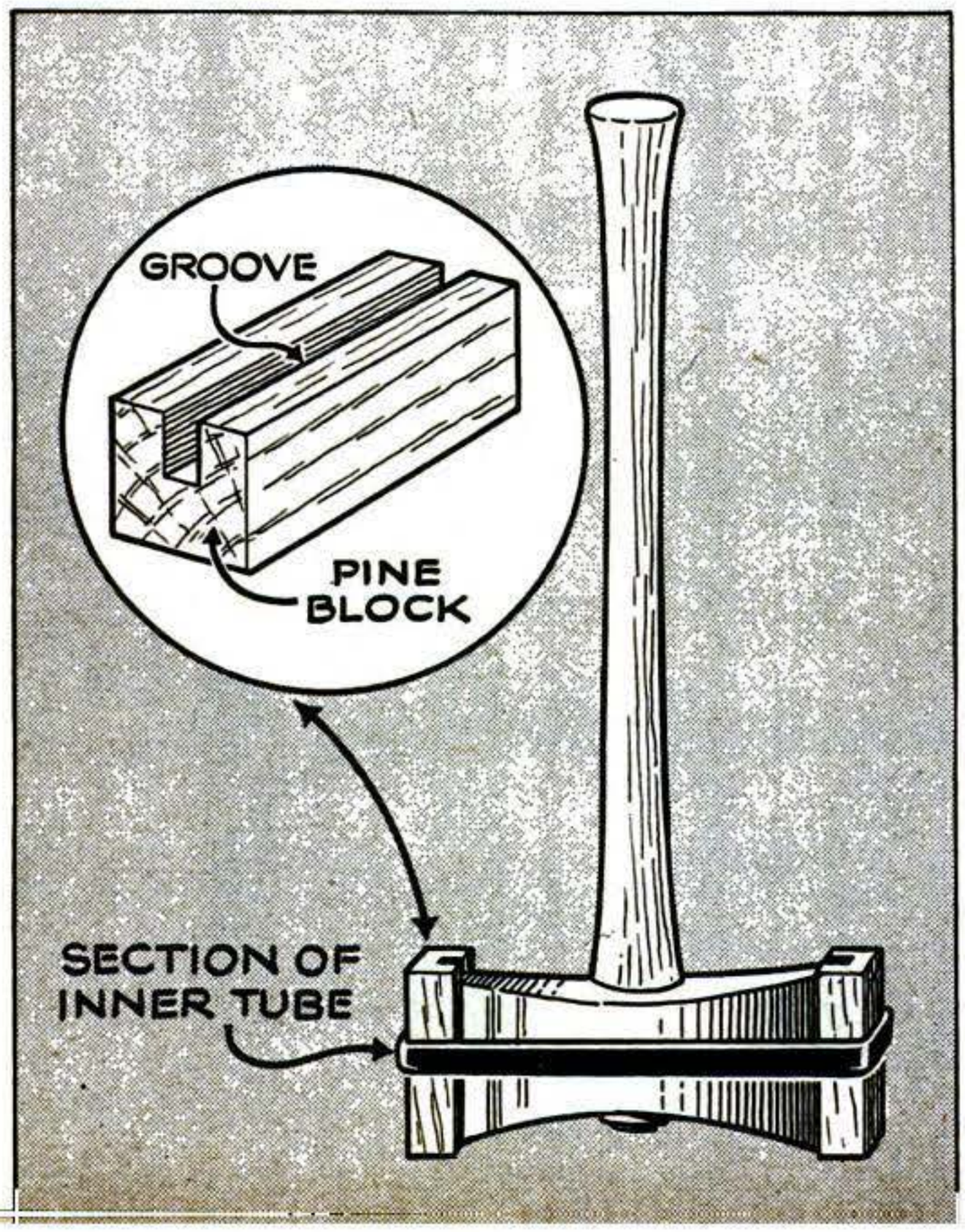


Boat Trailer Welded of Seamless Steel Tubing

DESIGNED primarily as a hand dolly for transporting a boat from cottage to beach, this lightweight trailer also can be towed with a car on short hauls over smooth pavement. It's made entirely of seamless steel tubing with welded joints.

The cradle can be built with supports for either a V-bottom or a round-bottom craft. For a V-bottom, rocker bars padded with sections of garden hose are provided. For a round bottom, small rubber-tired casters are fitted. In either case, the supports accommodate themselves to the boat bottom. A cleat is welded to the tow bar so the painter can be secured to prevent the boat from sliding backwards when towed by a car. The steel axle passing through the tubing between the wheels should be not less than ⅝" in diameter. The tow bar is 1" and other parts ¾" tubing.—*Hi Sibley, Nuevo, Calif.*



Wooden Blocks Protect Axe

Two slotted wooden blocks, as shown in the drawing at left, will protect the sharp edges of your axe bit when it is not in use. They're also a safeguard against accidents. A section of old inner tube holds the blocks together.—*V. H. Lamoy, Upper Jay, N. Y.*

Lag Screws Driven With Brace

I HAD to drive a number of lag screws with an open-end wrench and after a while it got to be quite a task. I switched to a brace and quickly drove the screws to within an inch, finishing up with the wrench. Of course, the proper pilot holes must be drilled first—*John E. Baker, Paterson, N. J.*

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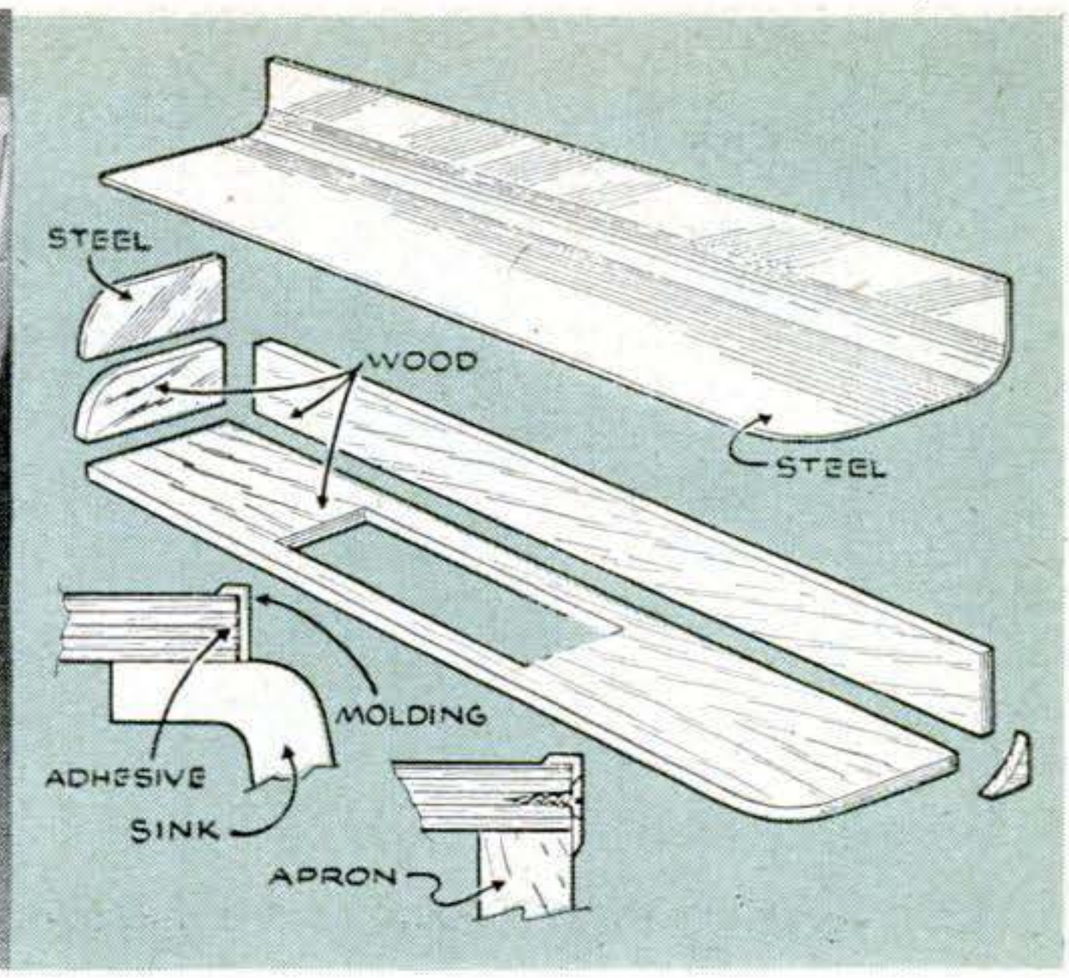


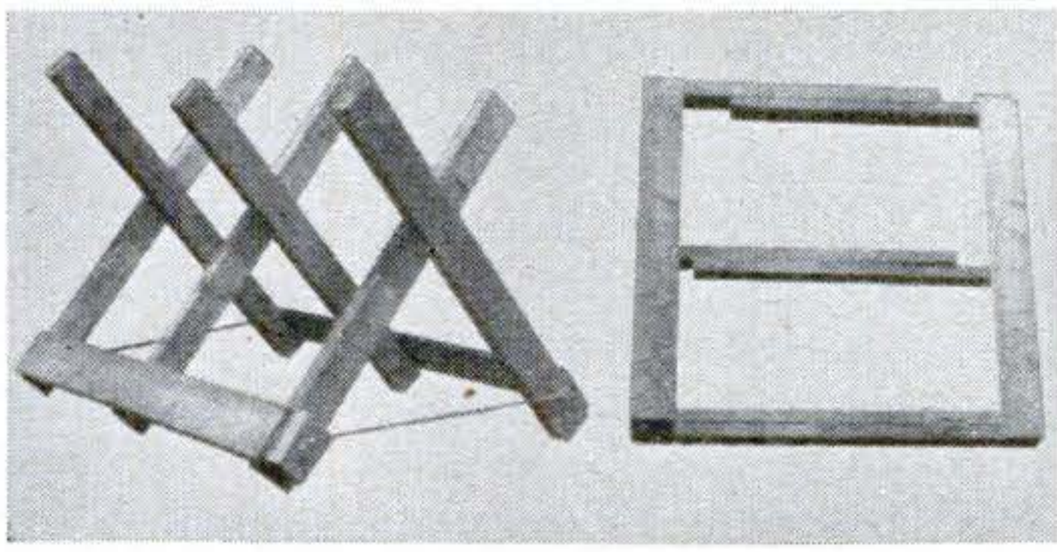
Stainless Steel Covers Drain

BACKED with ½″ plywood, stainless-steel sheet offers an excellent material for covering your kitchen-sink drainboard. Buy .018″ or .025″ annealed sheet.

Lay out the metal oversize. Trim to size after gluing to the plywood. Pliobond ® is a good adhesive for this. For a waterproof seal, also use this adhesive where the end splash board joins the other member. Use a piece of pipe as a form to bend a back curve.

To install the drainboard on an existing cabinet, attach blocks to the underside of the plywood at intervals and tie it into the original structure. Small angle brackets with one leg shortened can be used to attach the splash board to the wall. Cut away the wall surface and set the long leg directly against a stud. Notch the upper edge of the splash board to receive the other leg. A finish edging then hides the bracket.

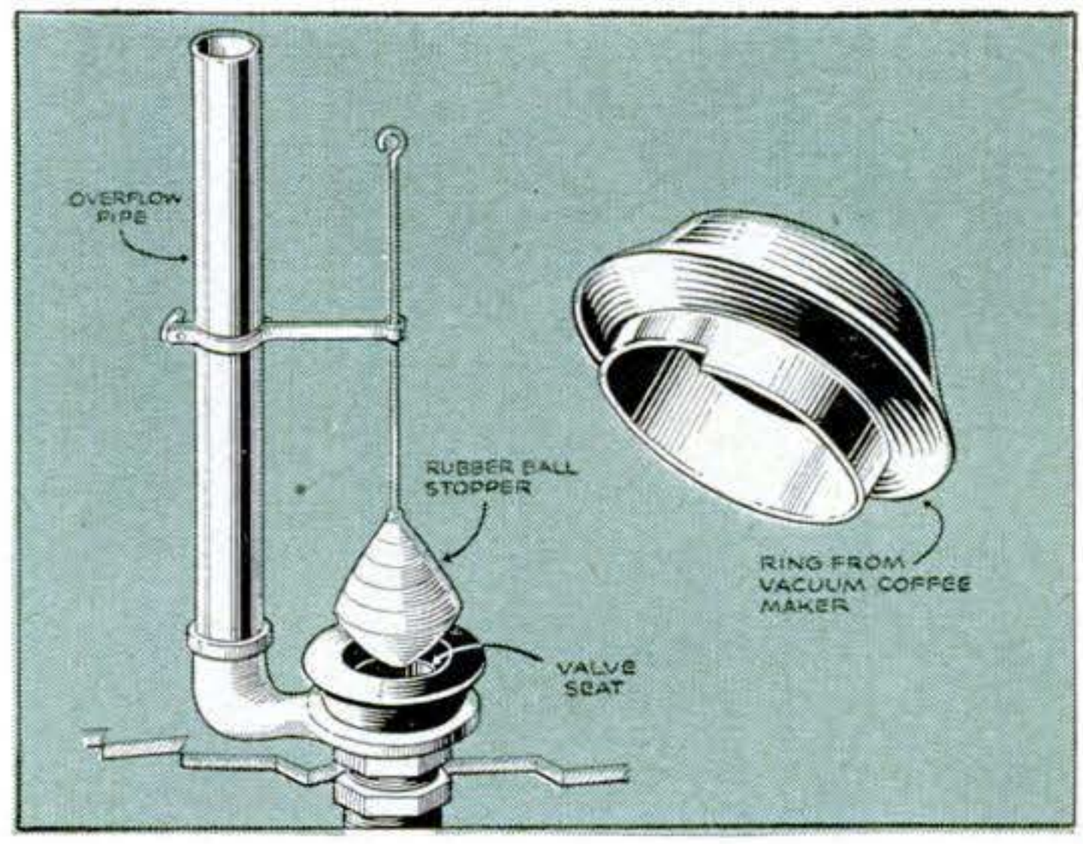
Install stainless steel or aluminum edging around the drainboard. A coating of the adhesive under the edging provides a waterproof seal.—*John L. Hathaway, Los Angeles.*



Sawhorse Folds for Storage

THERE's no need to keep that old sawbuck standing permanently out in the back yard. Here's one you can fold up and store away in the woodshed, where it's protected from the weather and is no longer an eyesore.

In making it, I used two-by-fours for the crosses, pivoting them with ⅜″ carriage bolts. The feet of the two-by-fours are tied together by ¾″ by 4″ boards screwed in place. It's best to determine the distance between each cross by the length of the logs you're likely to cut. Two long hooks fashioned from ⅜″ iron bars are placed across the ends to keep the horse rigid while in use.—*Arthur R. Tanner, Cold Spring, N. Y.*



Coffee-Pot Seal Repairs Valve

WHEN the seat of a flush-tank ball valve has become so pitted that the rubber stopper no longer makes full contact, a discarded vacuum coffee-maker sealing ring offers the means of a quick repair.

Drain the tank and dry the brass seat casting. Smear the outside of the casting with white lead or any plumber's sealing compound. Press the rubber ring in the overflow arm.—*W. H. McClay, Pasadena, Calif.*

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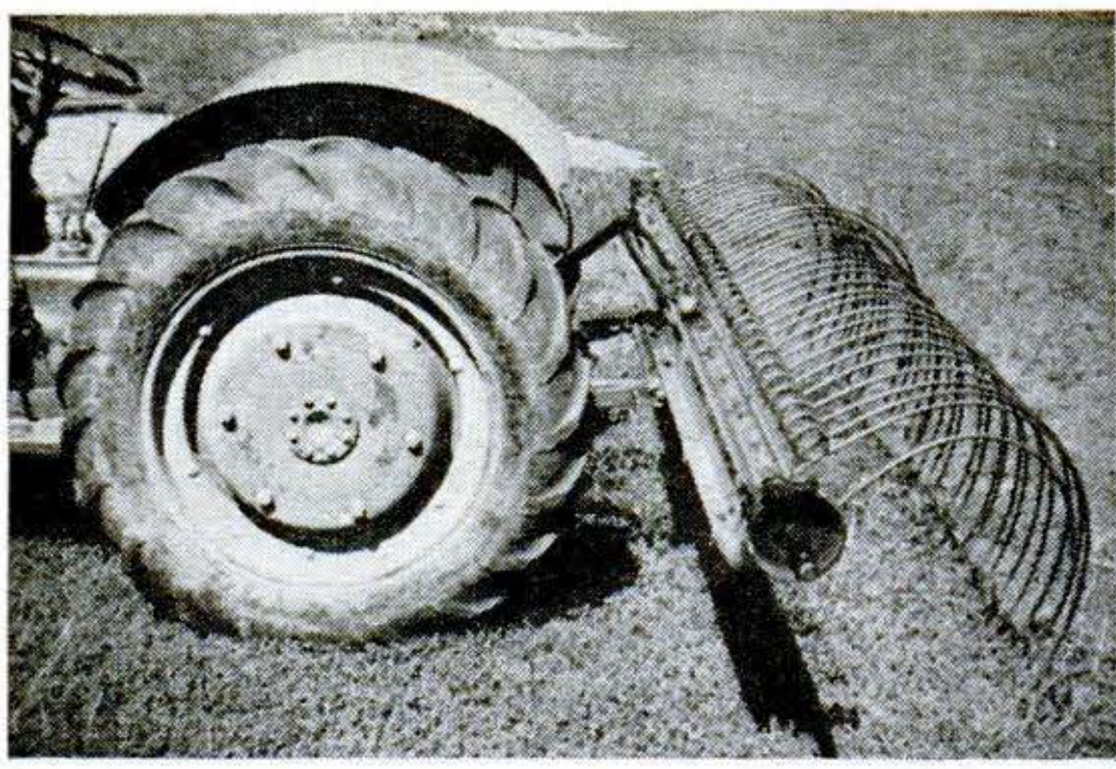
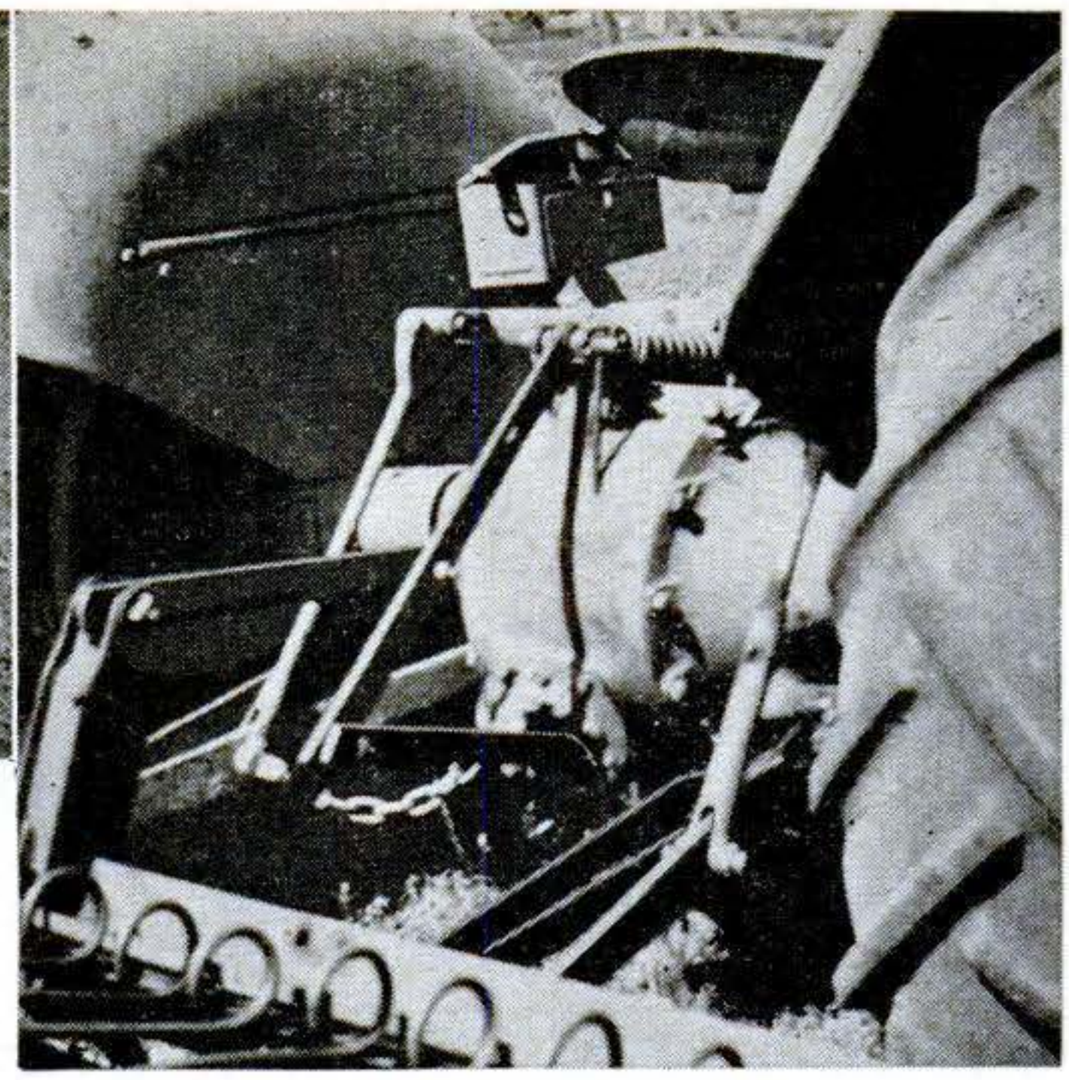
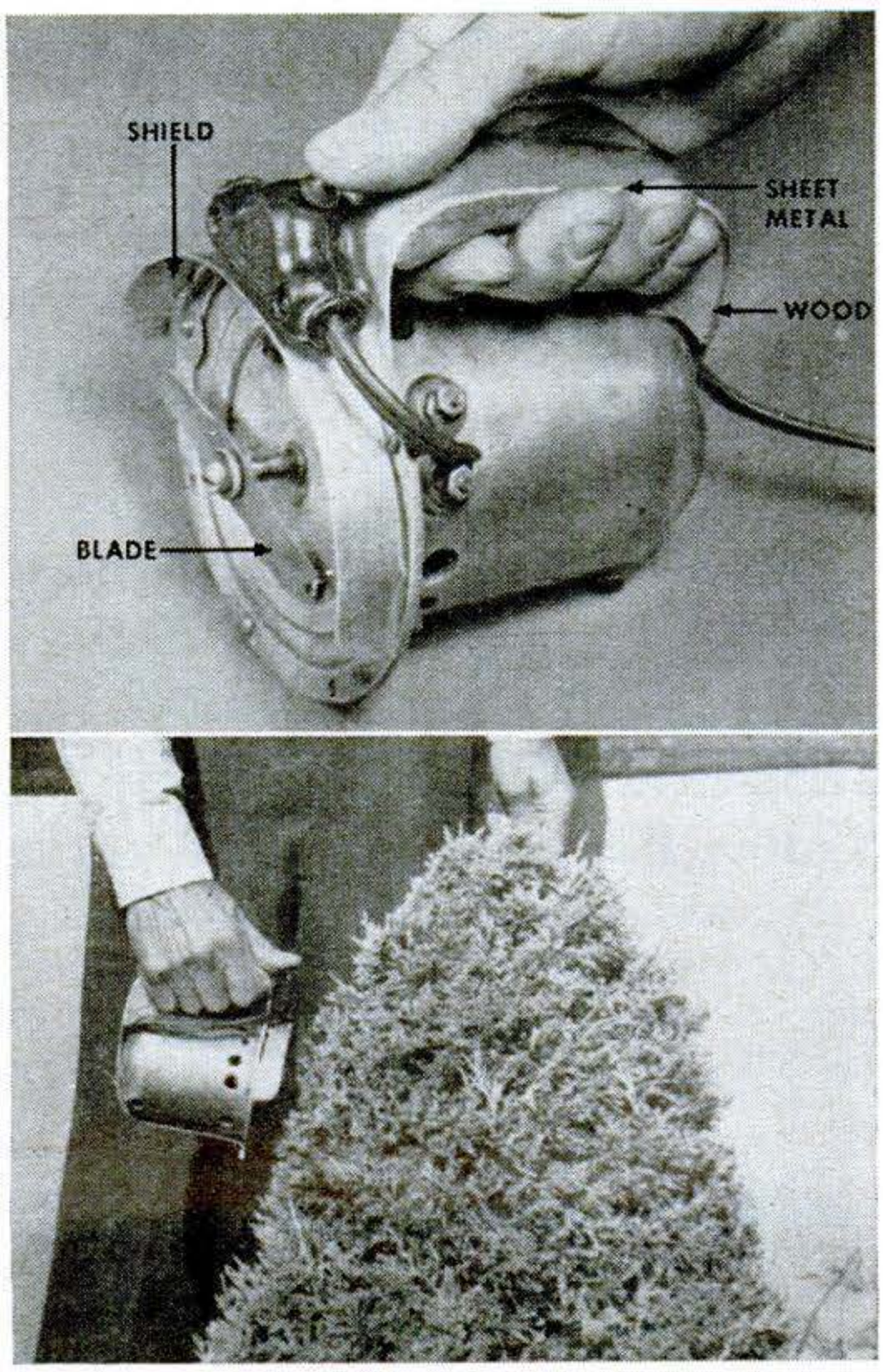




Horse Rake Used on Tractor

OLD horse rakes generally are consigned to the junk pile, but I found that a few hours' work can convert an old one to a one-man hydraulic rake for use with a tractor. Instead of buying an expensive hydraulic cylinder to operate the trip as on commercial rakes, I worked out the leverage system shown in the photo. When the hydraulic lever is pulled back on the tractor, the drawbar comes up. But at a predetermined level the bar trips the rake teeth up. By experimenting, you'll find where you want the rake to trip.

First remove all parts of the old rake except the main beam, the beam that holds the rake teeth, and the pivots. By using spacers and two bolts, you can bolt the main frame of the rake to the drawbar. To stabilize the rake, run an extra brace to a drawbar stay. In the photo at right, it can be seen running parallel to the right stay.—*Howard L. Corwin, Rhame, N. D.*

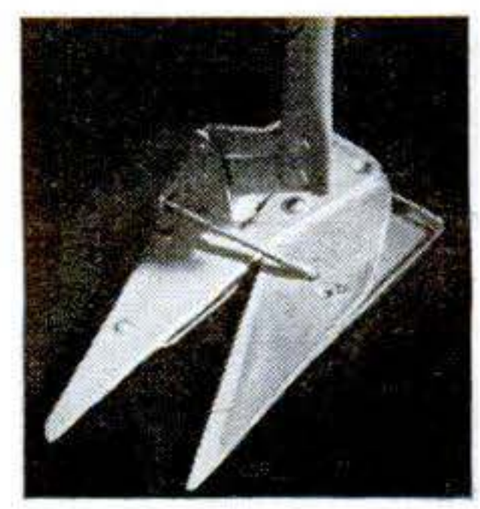


Old Motor Makes Trimmer

IT'S easy to keep shrubs in trim with this clipper made from an old vacuum-cleaner motor. The blade, sharpened on opposite sides at each end, can be an old butcher knife, a piece of hacksaw blade, or any piece of thin tempered steel. Drill a hole in its center for attaching to the motor. At left, the photos show the handle and the blade guard under the switch. Both are bent from sheet aluminum. These parts will have to be shaped and attached to suit the motor you use.—*Benjamin Nielsen, Aurora, Neb.*

Grass Clipper Has Long Handle

MADE by the Garden Tool Mfg. Co., Racine, Wis., this long-handled trimmer enables you to clip along sidewalks, trees, or fences without crawling on your hands and knees. Pressure on the handle operates the blades while you remain in a standing position.



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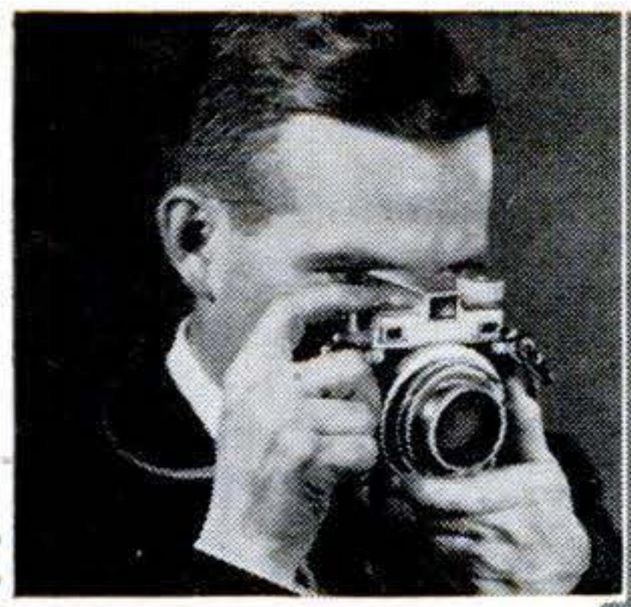
3 Kinds of Camera



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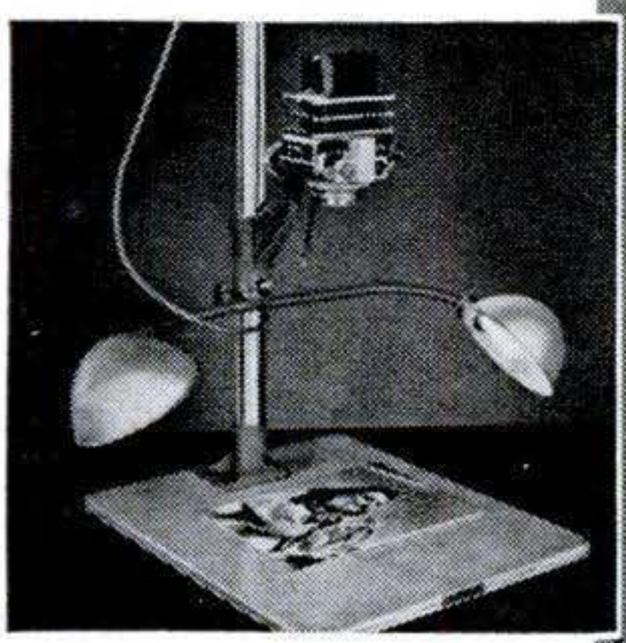

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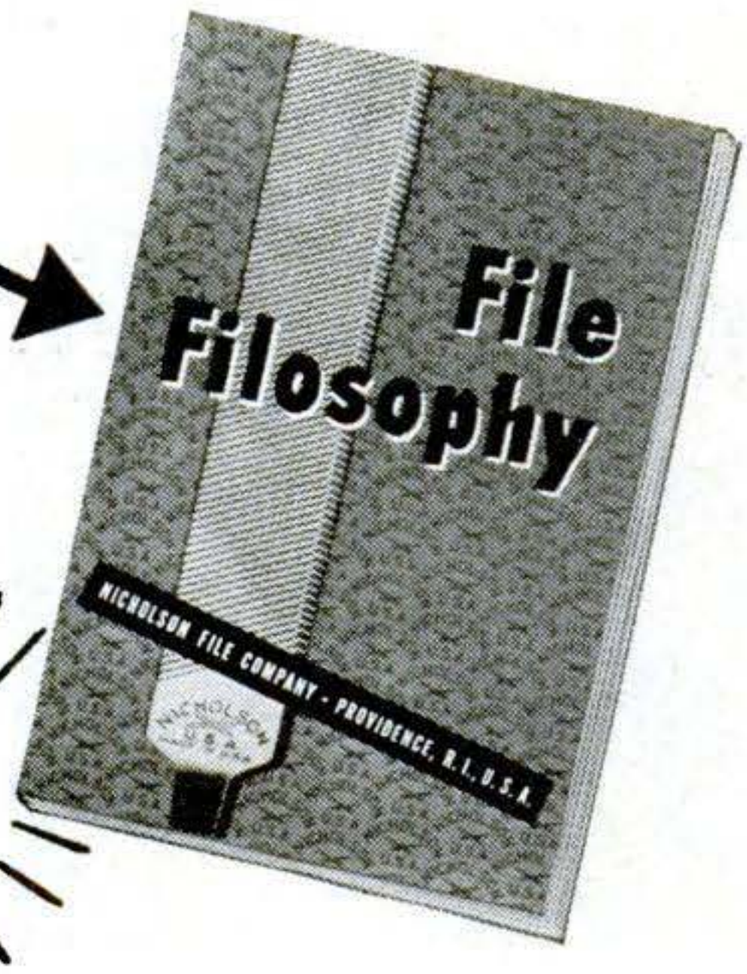

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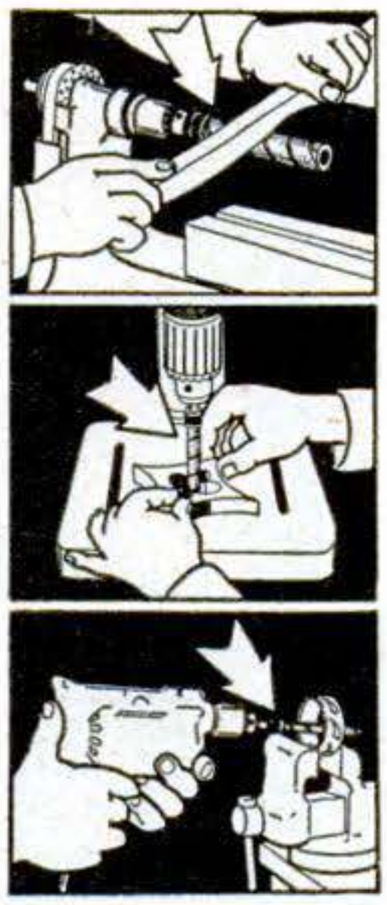

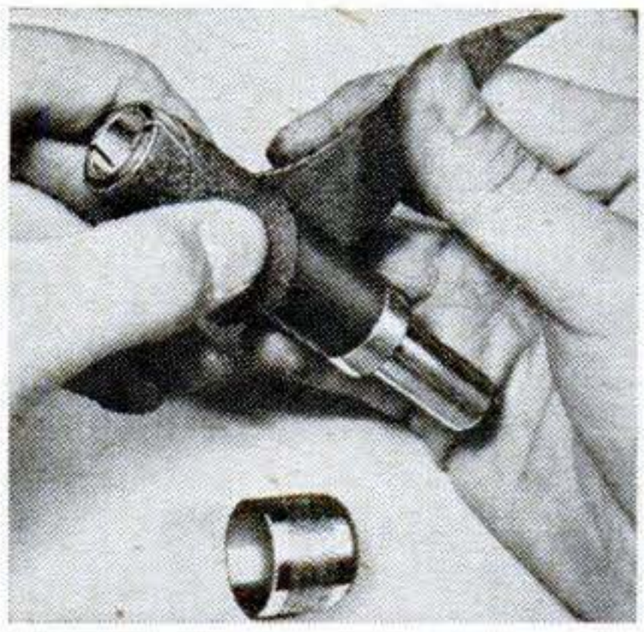

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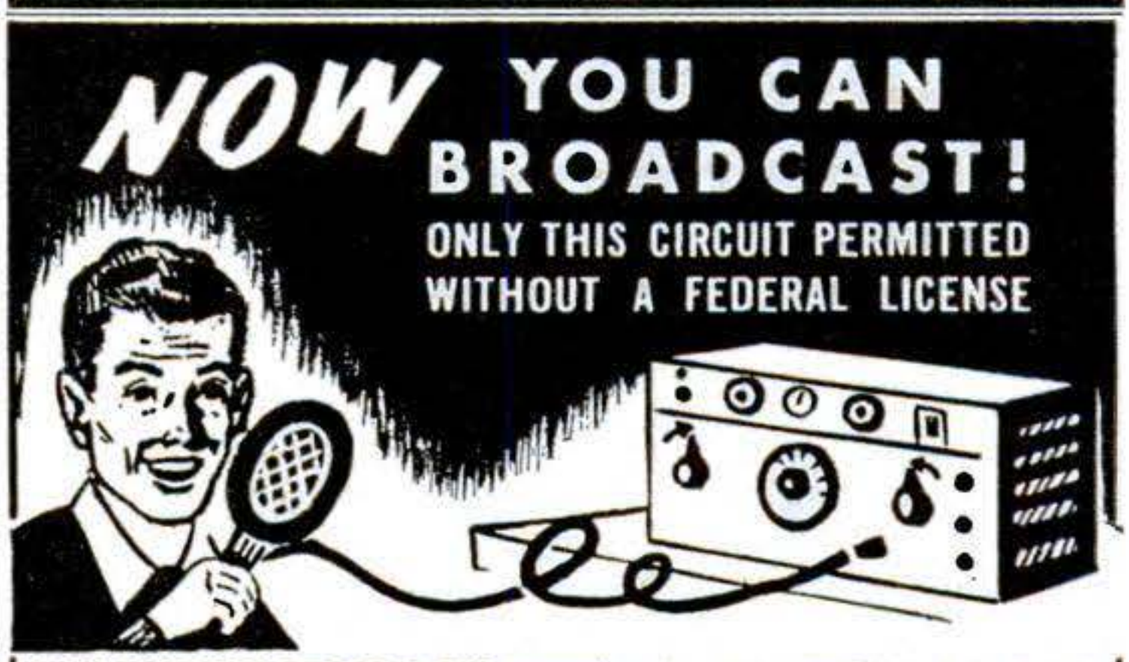

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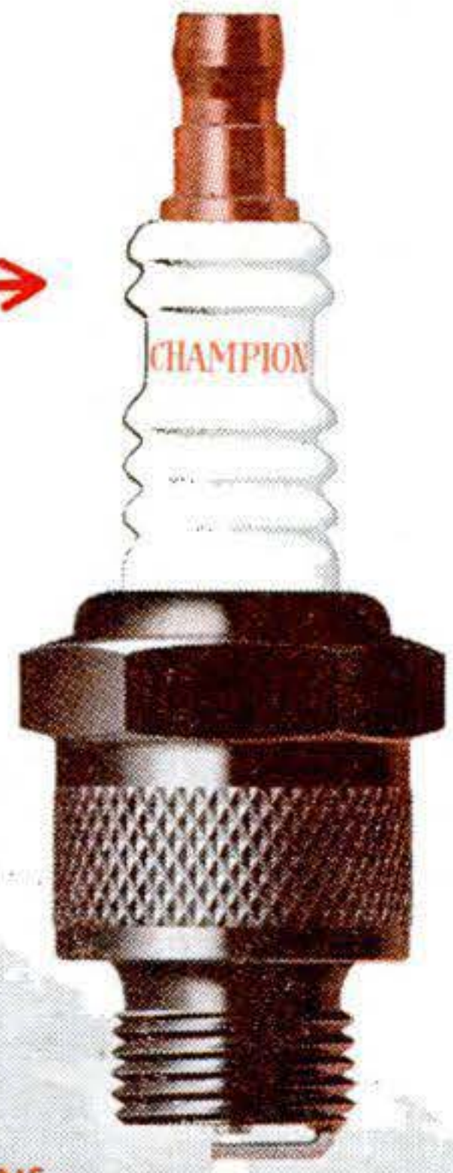

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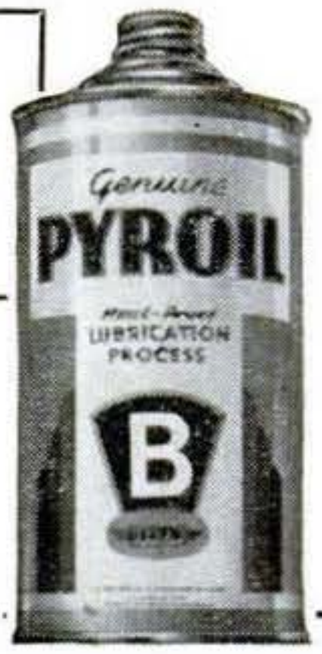

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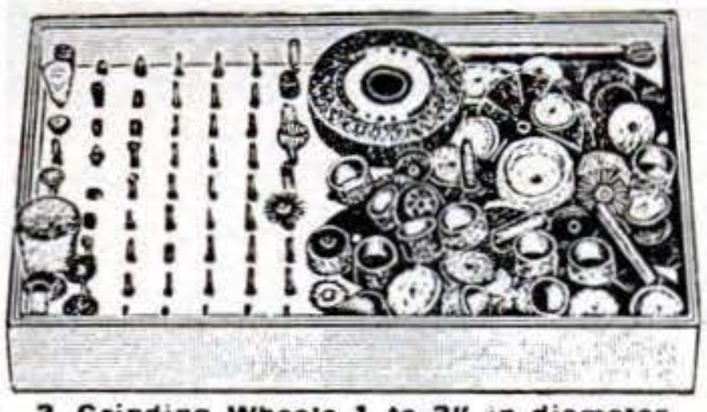

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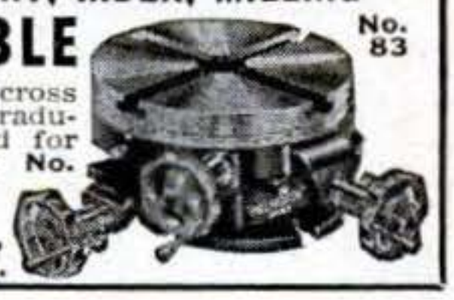

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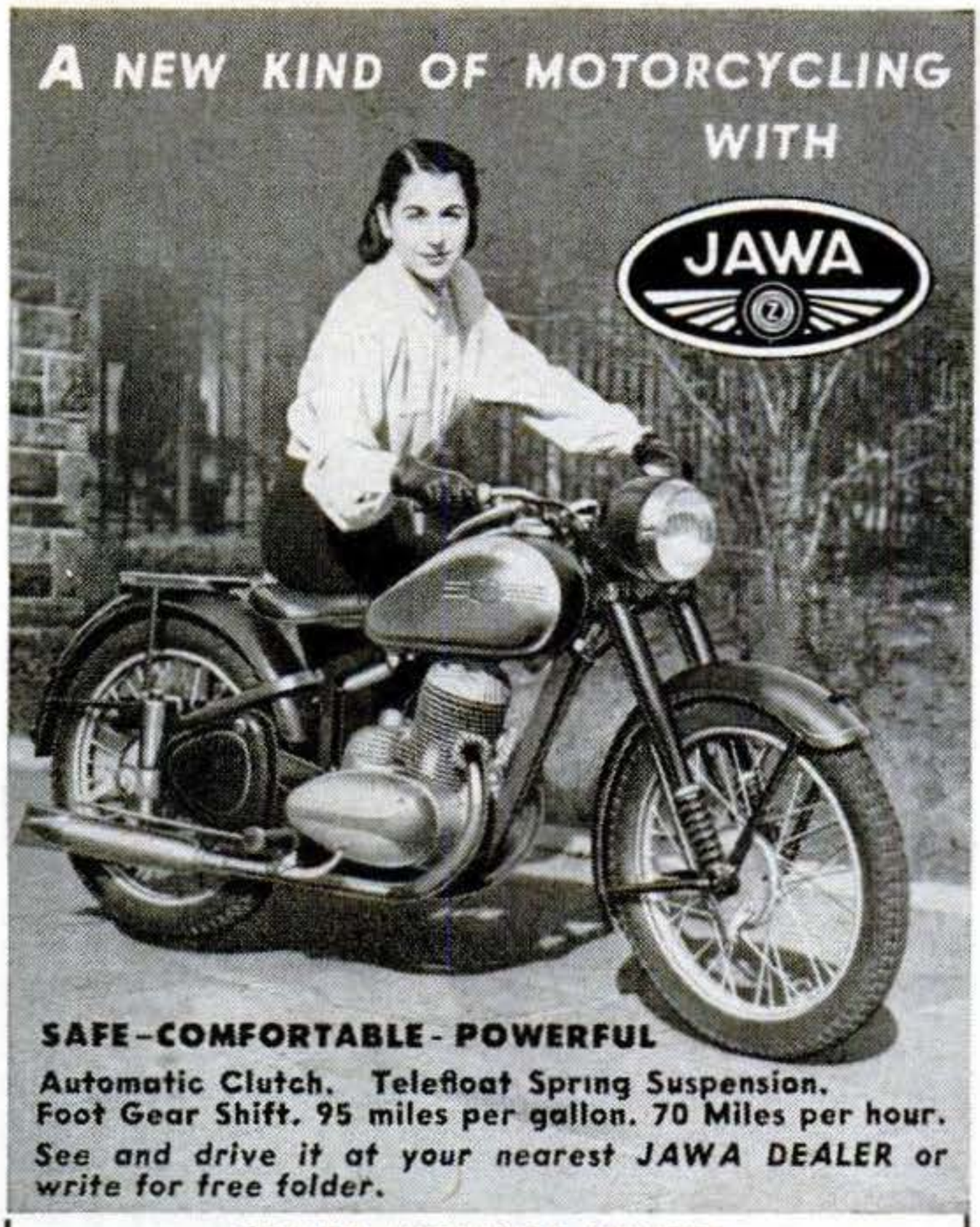

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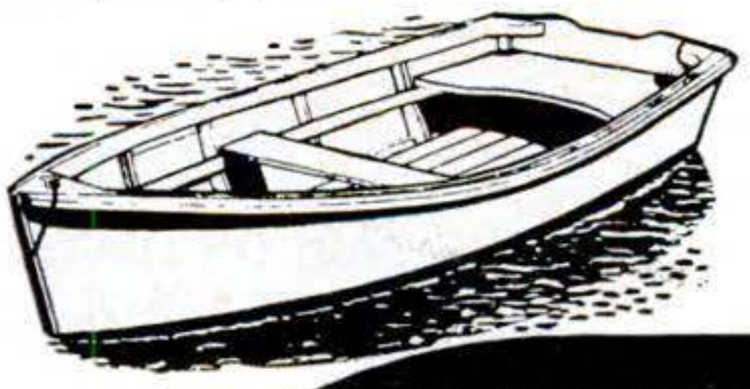

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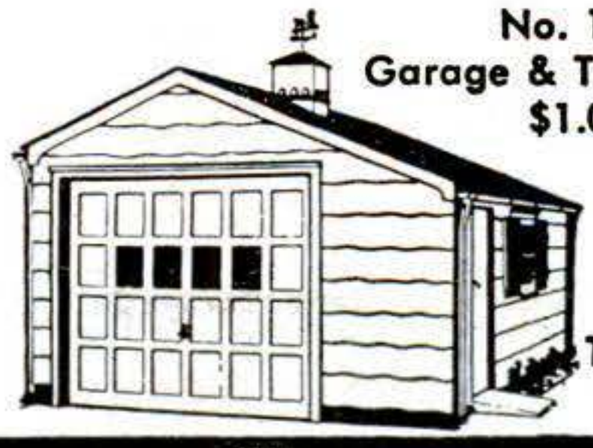

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The Atlas 8″ gives you so much more saw for your money it's hard to make comparisons. It has a tilting arbor — *table is always flat.* Cuts 2⅜″ deep. The table is *grey-iron — precision-ground.* It is 22″ x 18″ (22″ x 35½″ with two extensions) and has 10⅝″ working surface ahead of blade — the capacity you'll want for big boards and panels. The new-type rip fence locks at *both* ends — releases instantly for easy positioning. Vernier control for fine adjustment. Blade height and angle controls work smoothly. Dust-sealed *ball bearings* assure long, smooth, accurate service.

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- 21x27 in. table tilts full 45 degrees, 13 in. capacity in front of blade
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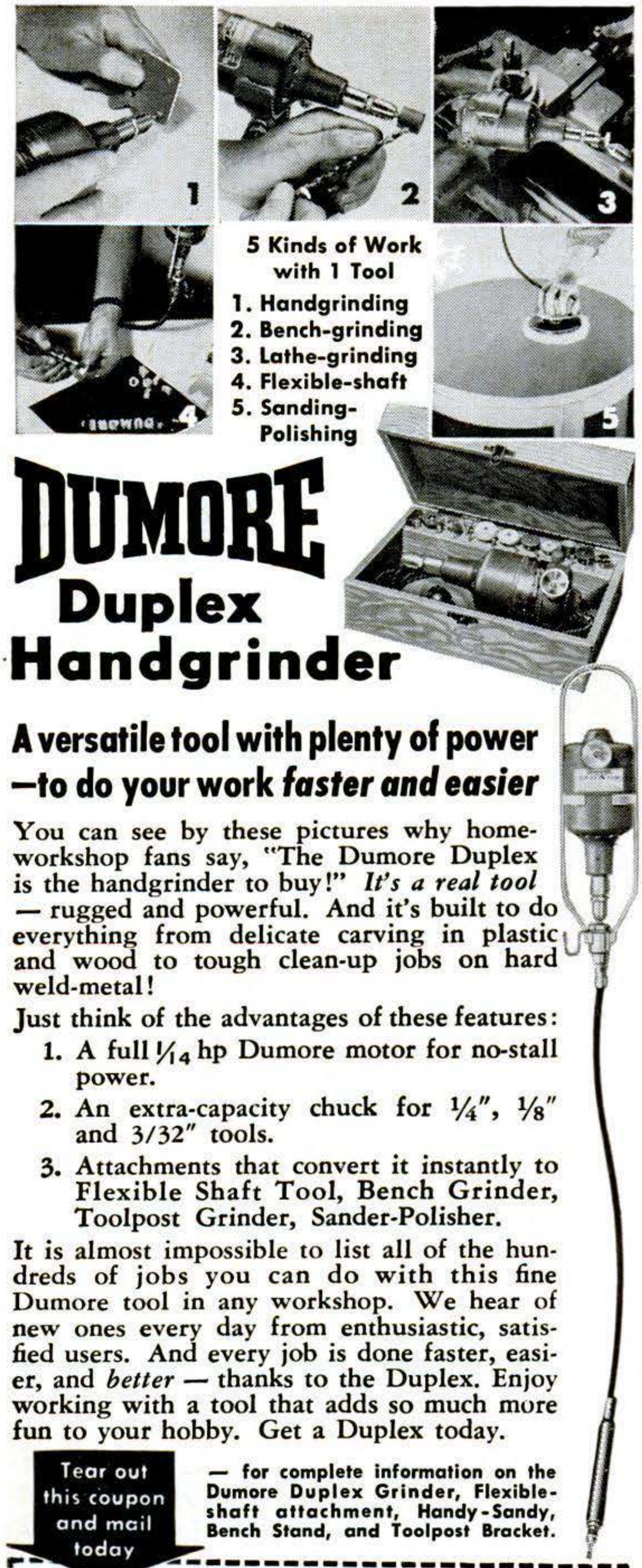

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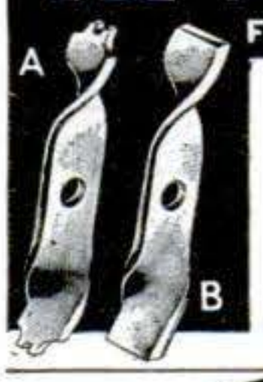

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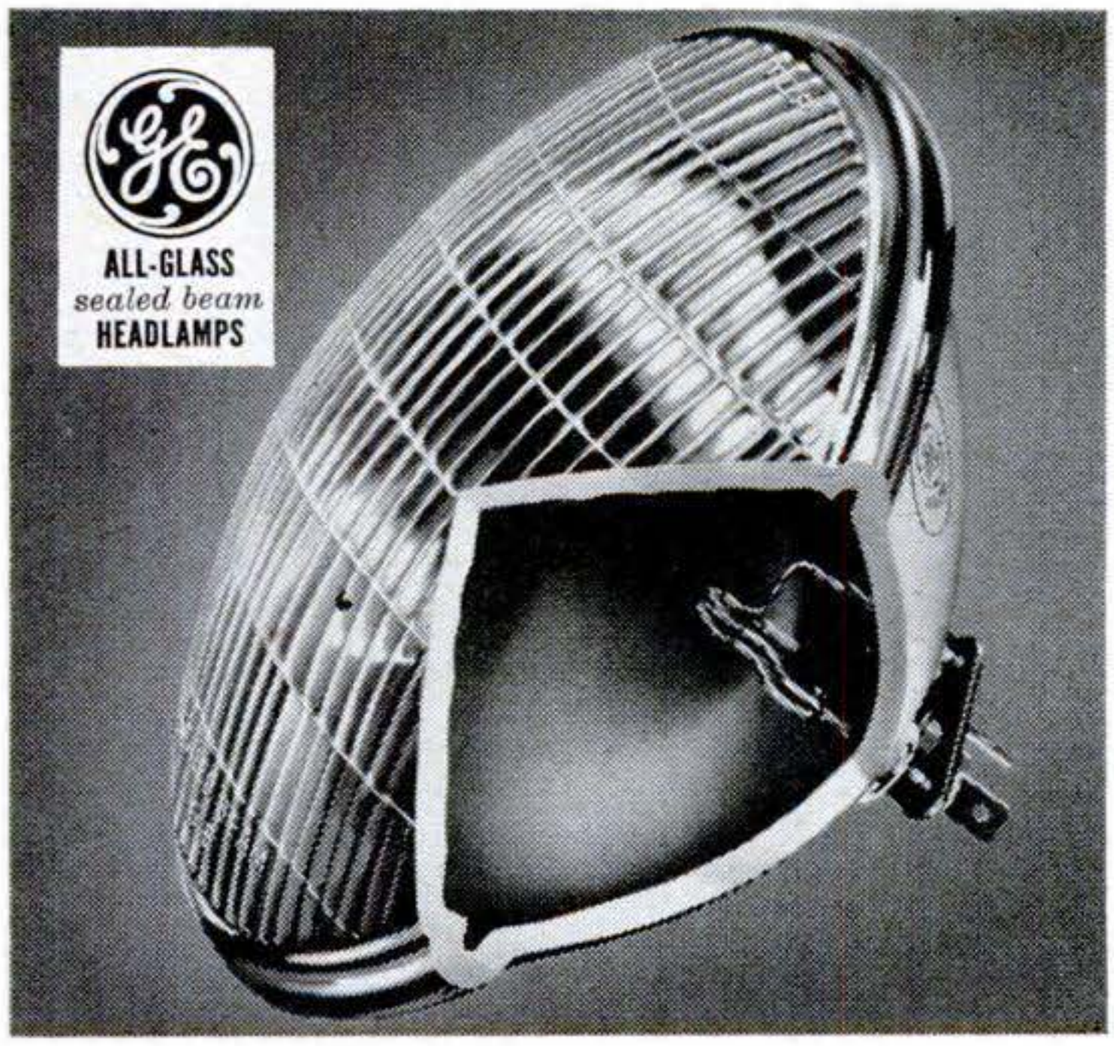
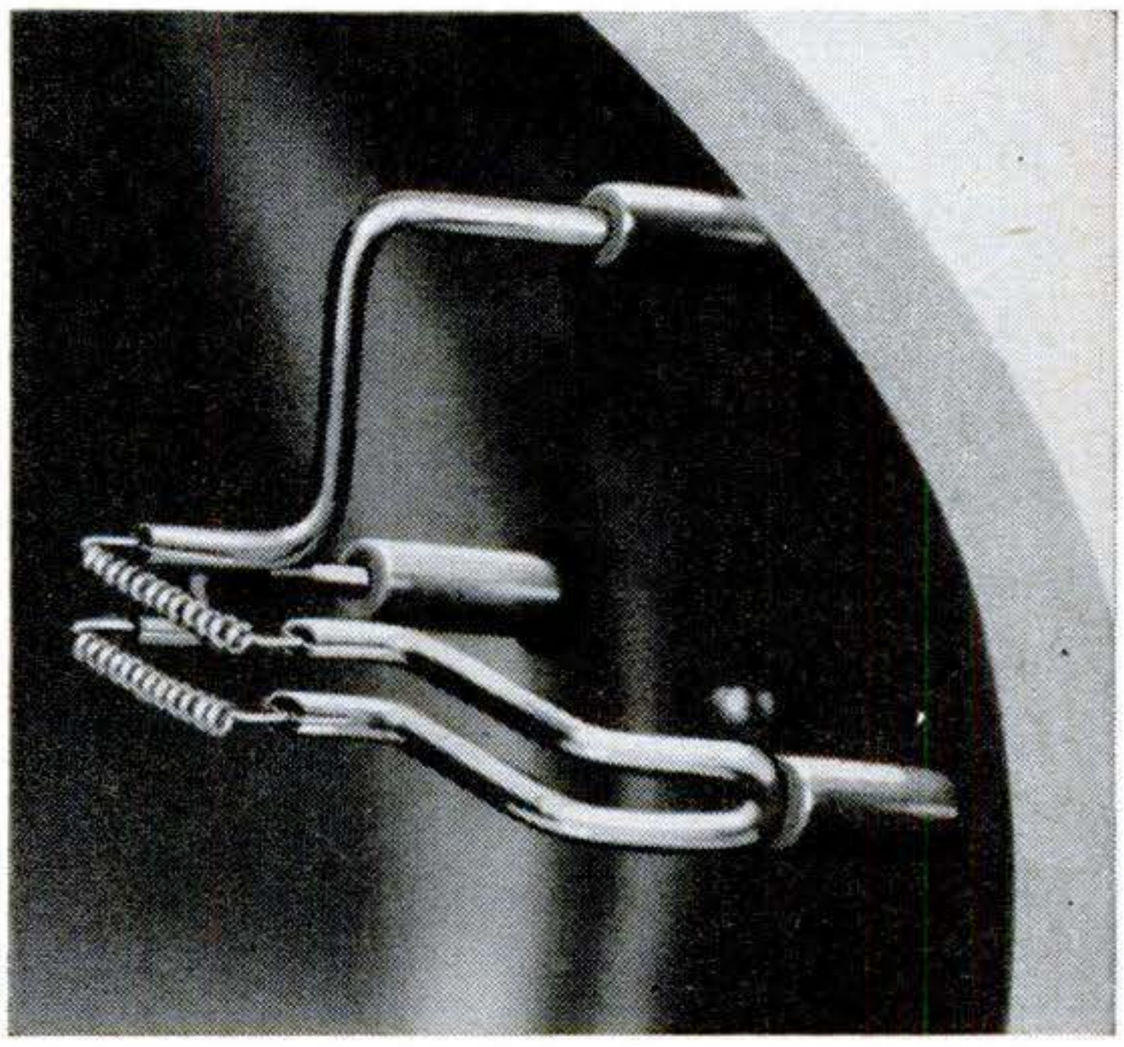
Why General Electric headlamps give more light

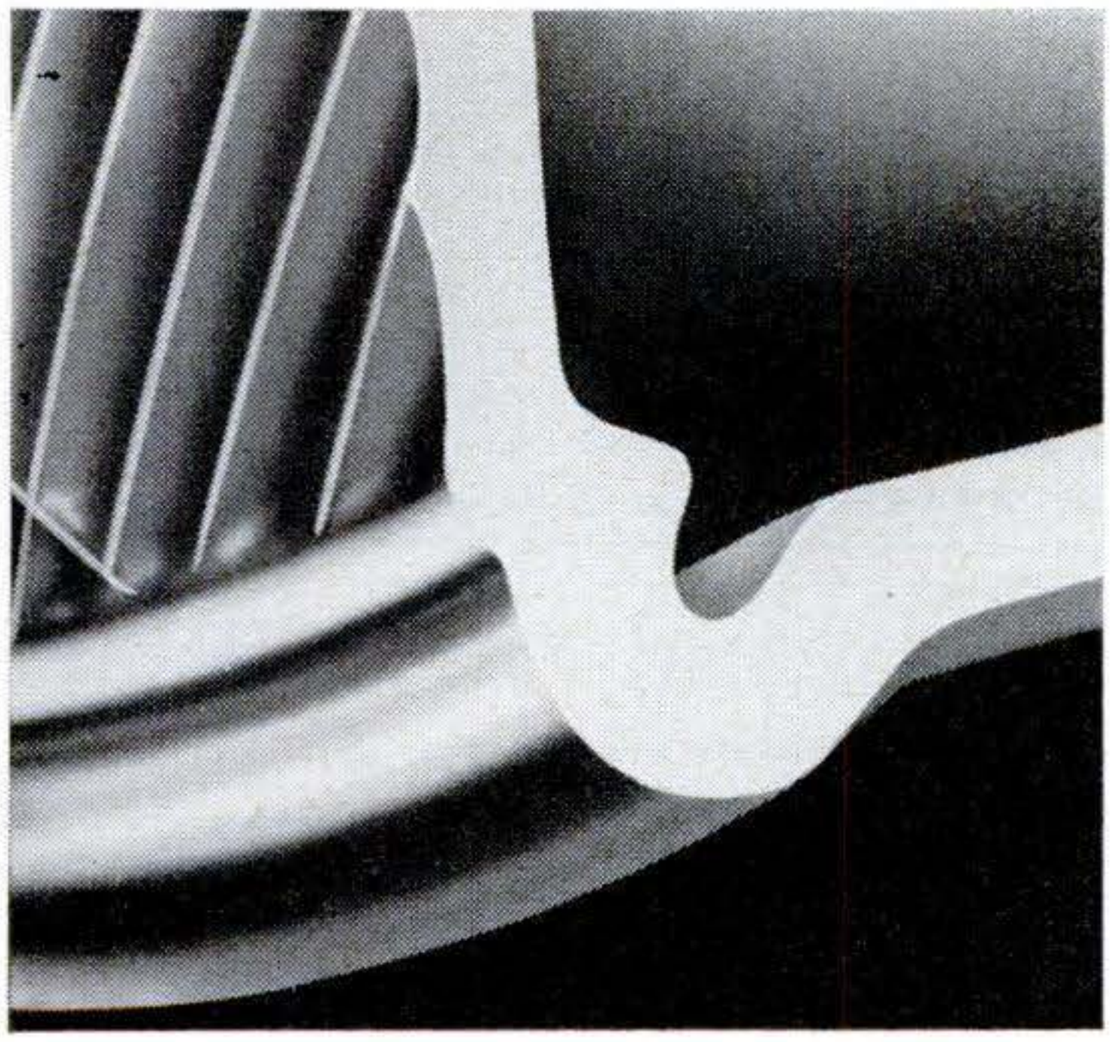
—now 12% more light on the road . . . and they do not grow dim



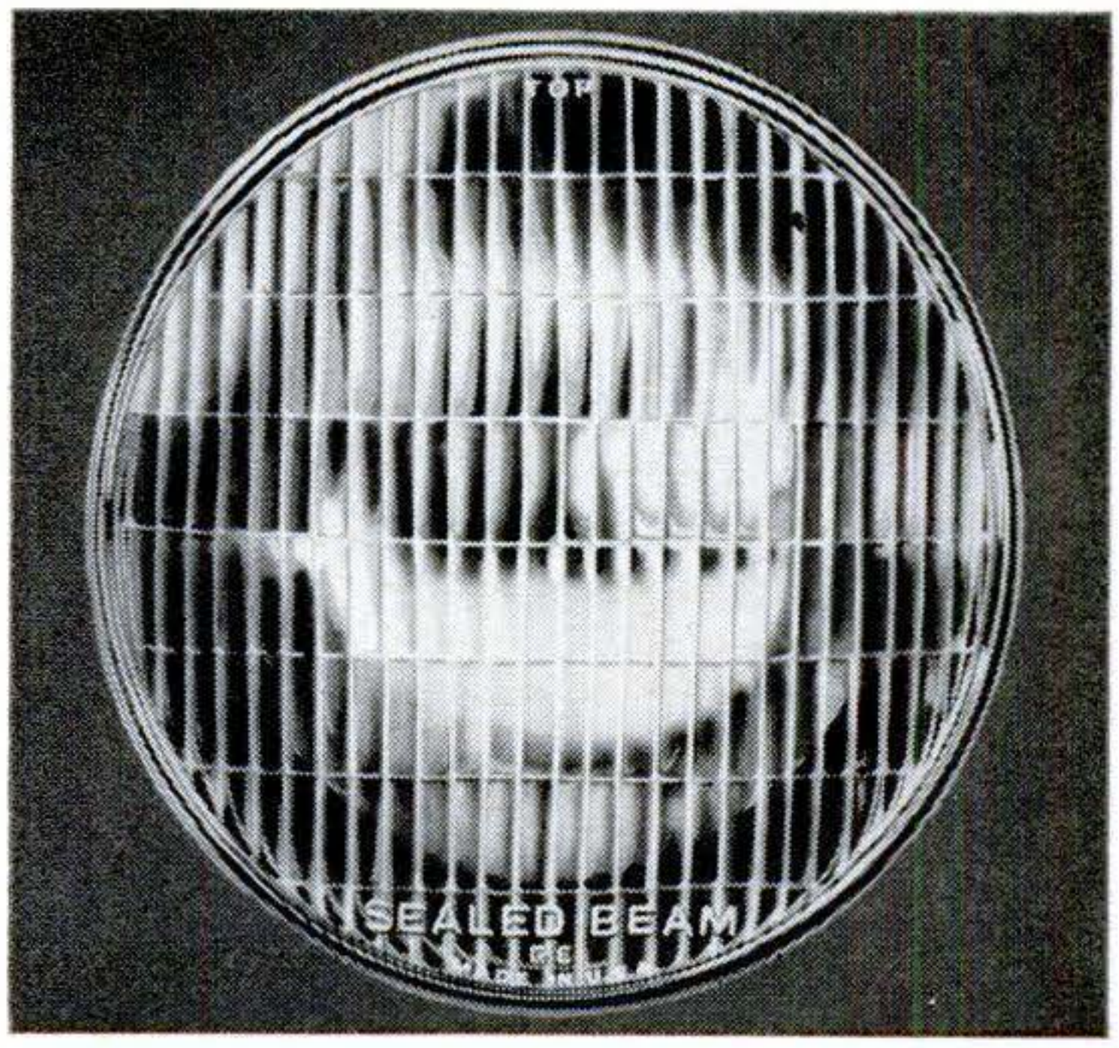
1. TODAY'S GENERAL ELECTRIC "ALL-GLASS" sealed beam Headlamp is a rugged, one-piece bulb that gives you more light than ever. These pictures show why.



2. BIG, IMPROVED FILAMENTS give 12% more light on the road for driving, 16% more light for passing. And they won't shake loose on bumpy roads.



3. THE ONE-PIECE, all-glass construction keeps out all light dimming dirt and moisture. The average General Electric headlamp gives 99% of original light output even at the end of its life. *It does not grow dim!*



4. THE LENS is rugged hard glass, precision made to put maximum light on the road. Be sure to have your car lights checked next time you leave your car for service. And when you need replacements, make sure you insist on General Electric!

You can put your confidence in—

GENERAL ELECTRIC

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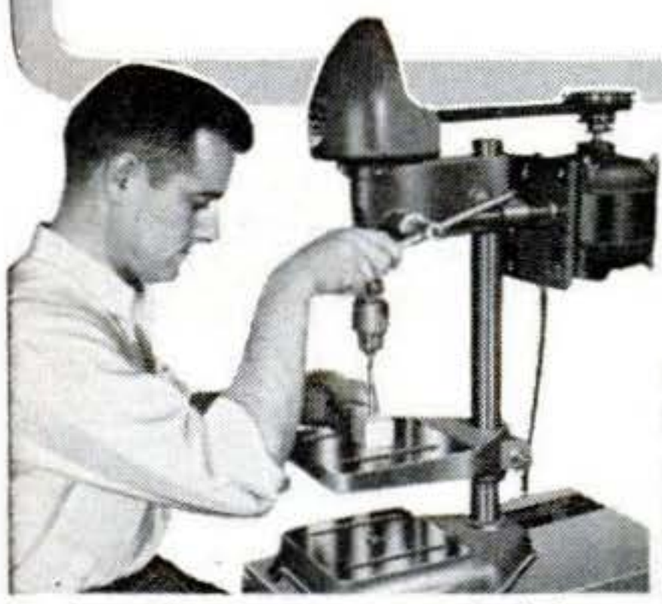

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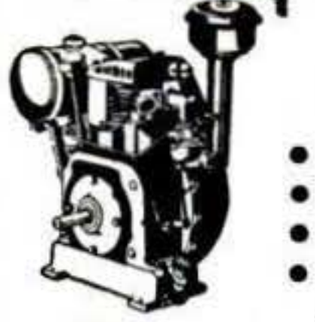

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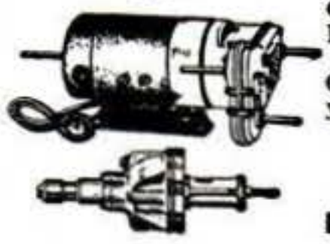

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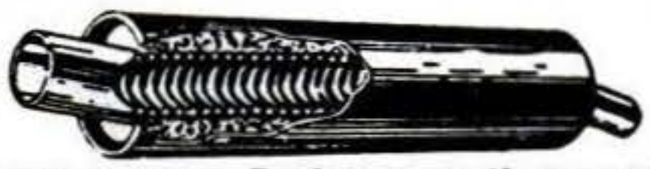

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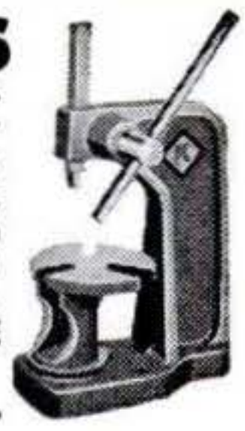

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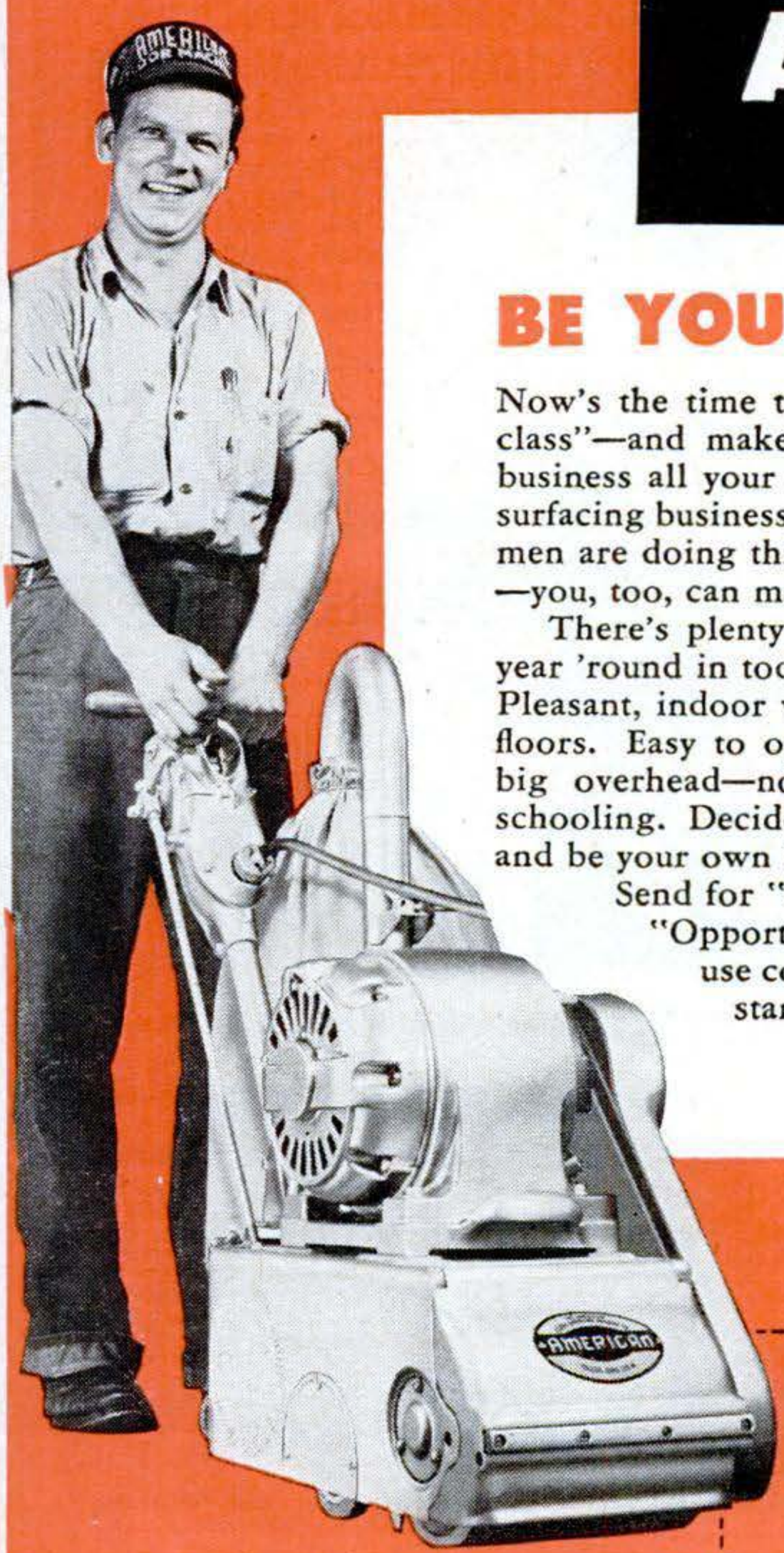

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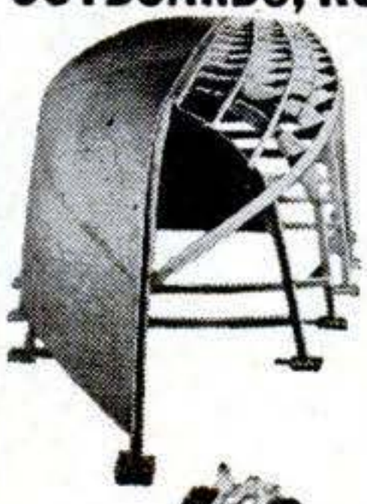

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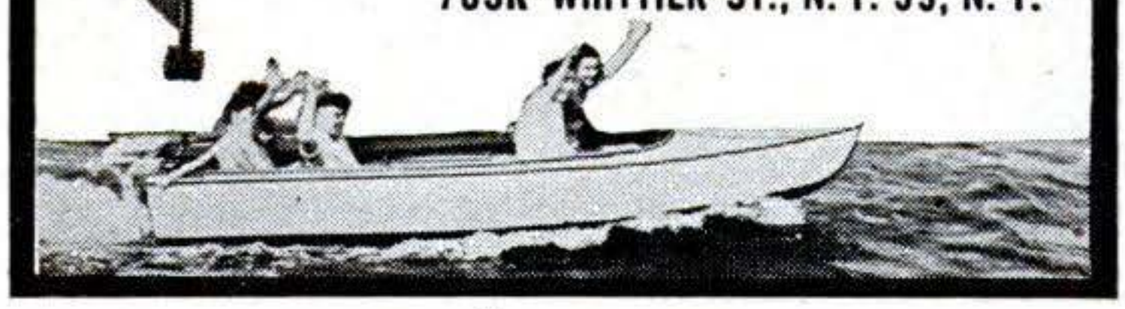

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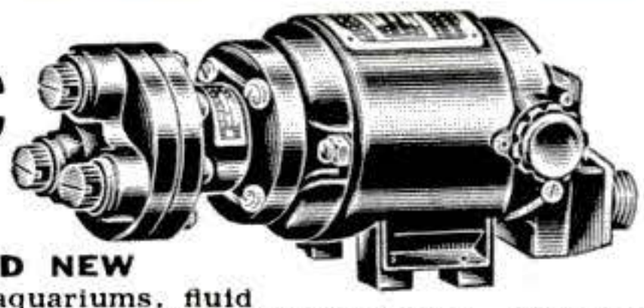

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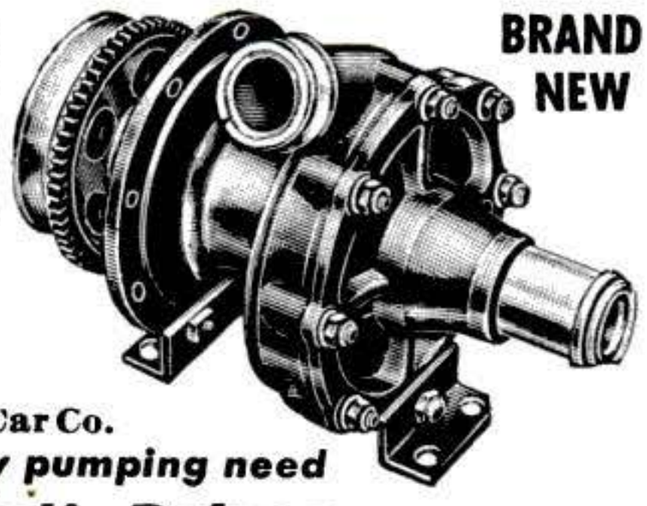

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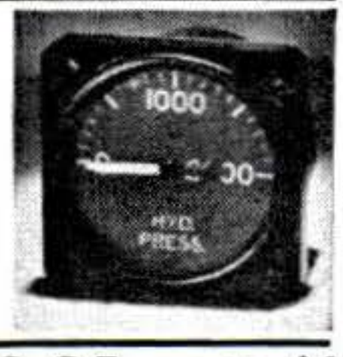

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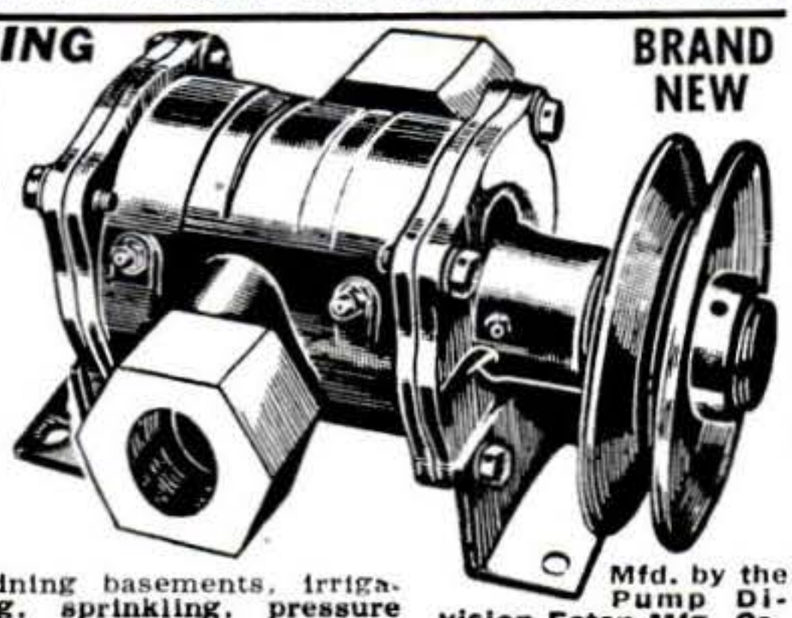

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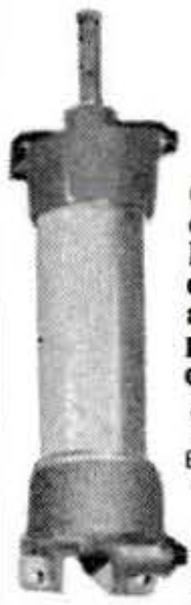

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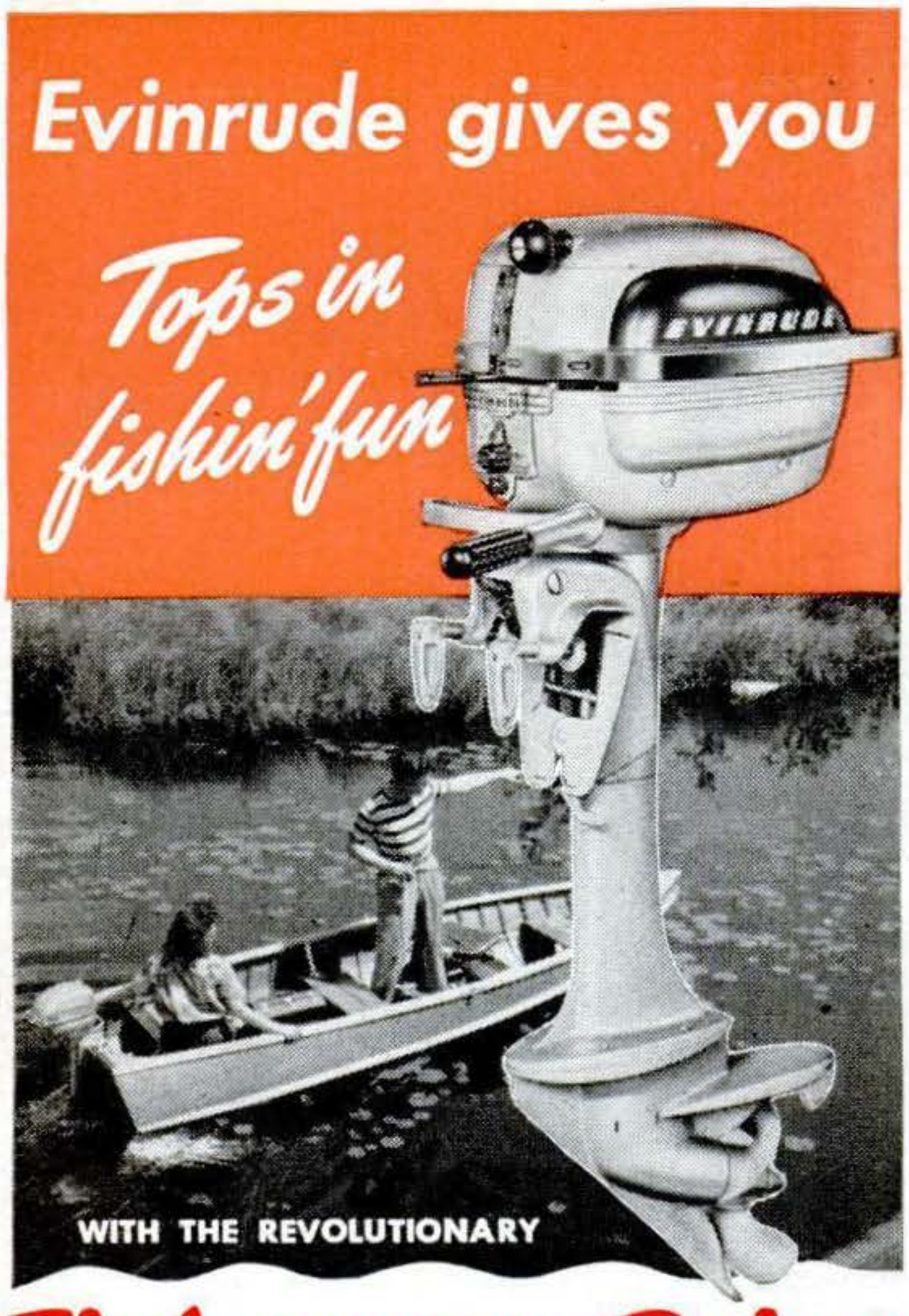

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Yes . . . with this patented Drive you can go "anywhere there's water to float your boat." And what a difference *that* makes to your boating and fishing fun! No longer need you dodge reeds and weed beds! Or hurriedly cut the power over shoals, snags, rocks! There's *nothing like it* for carefree boating in all waters!

through weeds

over snags

over shoals

SEE YOUR EVINRUDE DEALER . . . and see the complete line of 40th Anniversary models . . . 1.5 to 50 horsepower . . . *the right motor for every boat!* Look for your dealer's name under "Outboard Motors" in the yellow pages of your phone directory. For free catalog write EVINRUDE MOTORS, 4248 N. 27th St., Milwaukee 9, Wisconsin.

FREE Write for full-color catalog of complete line—gives helpful information on features, boats, speeds.

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FIRST IN OUTBOARDS • 40th YEAR

NEW Catalog

ATTACHMENTS AND ACCESSORIES FOR LATHES

Describes equipment that will make your lathe more versatile, such as:

Milling Attachments	Center and Steady Rests
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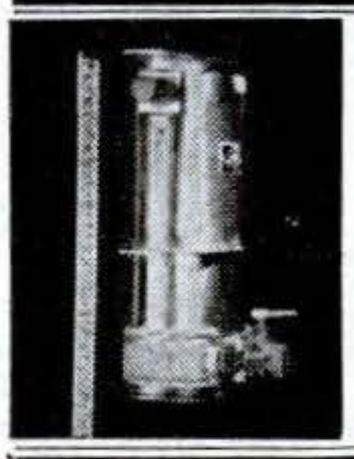

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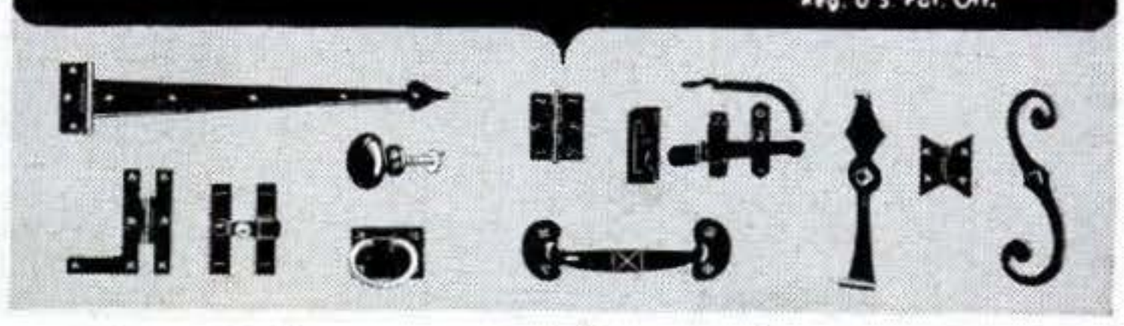

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Does all circular-saw work . . . quickly, easily, accurately

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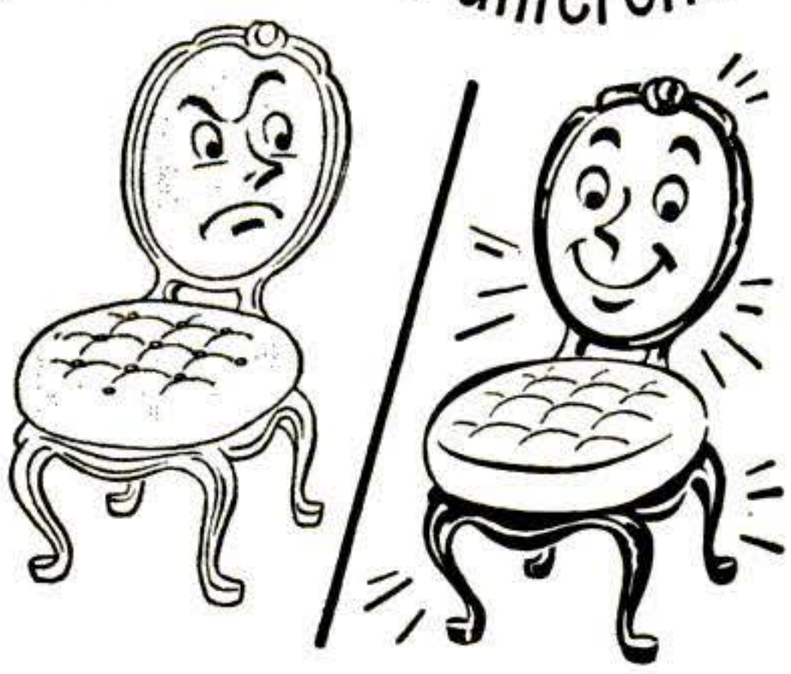

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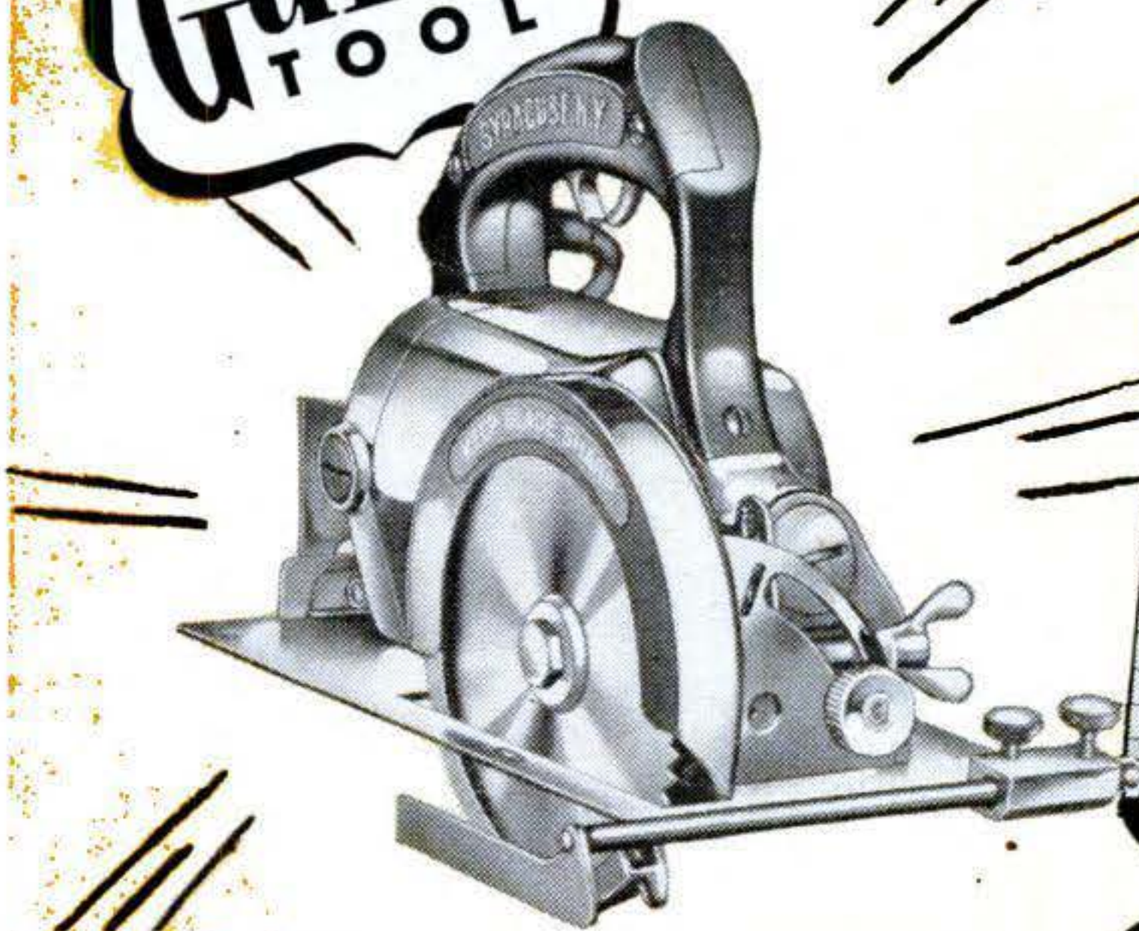
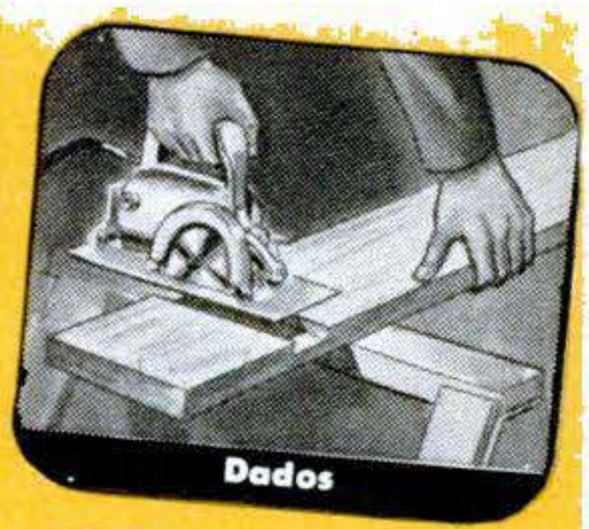
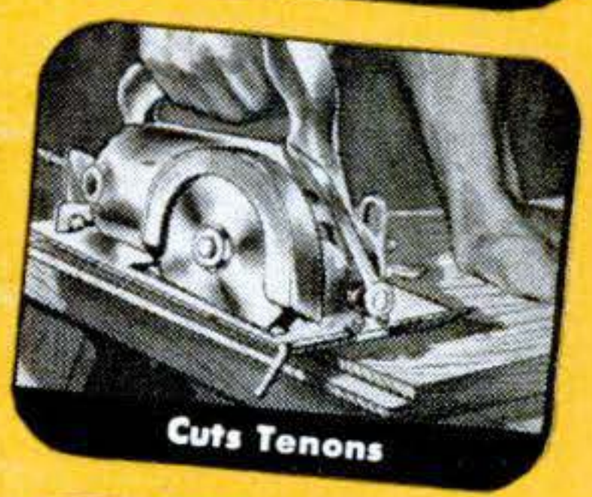
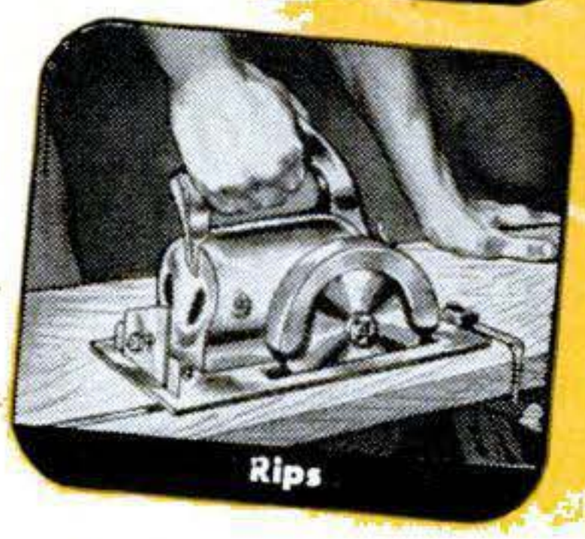


Mitres


Dados

Cuts overhang


Cuts Tenons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The Guild Saw actually saves you hours of back-breaking work in the home, on the farm, in light industrial use. It cuts in 5 minutes what would take you at least 30 minutes or more to do with a hand saw! Operates in any position . . . does everything a hand saw does . . . and then some. And—it's inexpensive!

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Up to 10 Times *FASTER!*

GUILD SANDER

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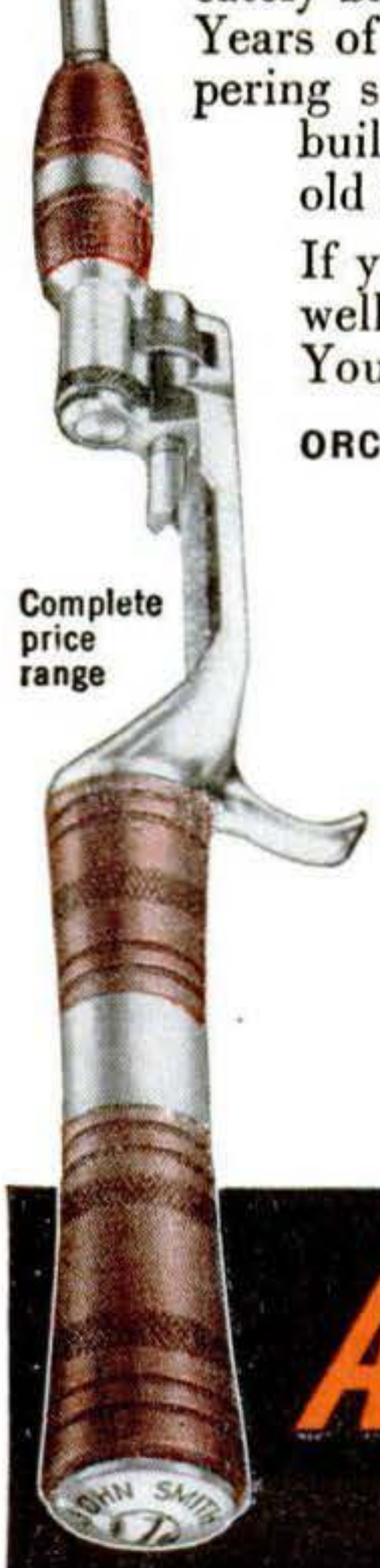

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Owner's Name On Handle

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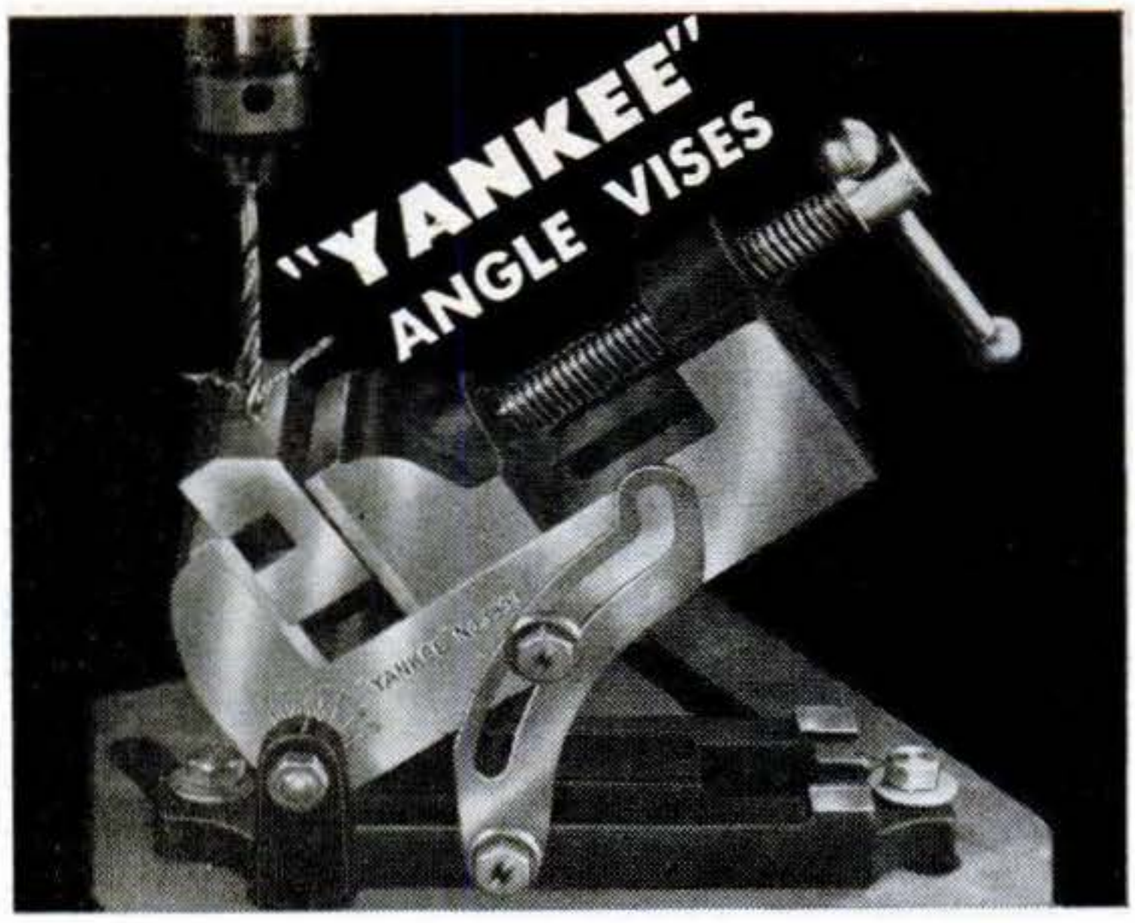

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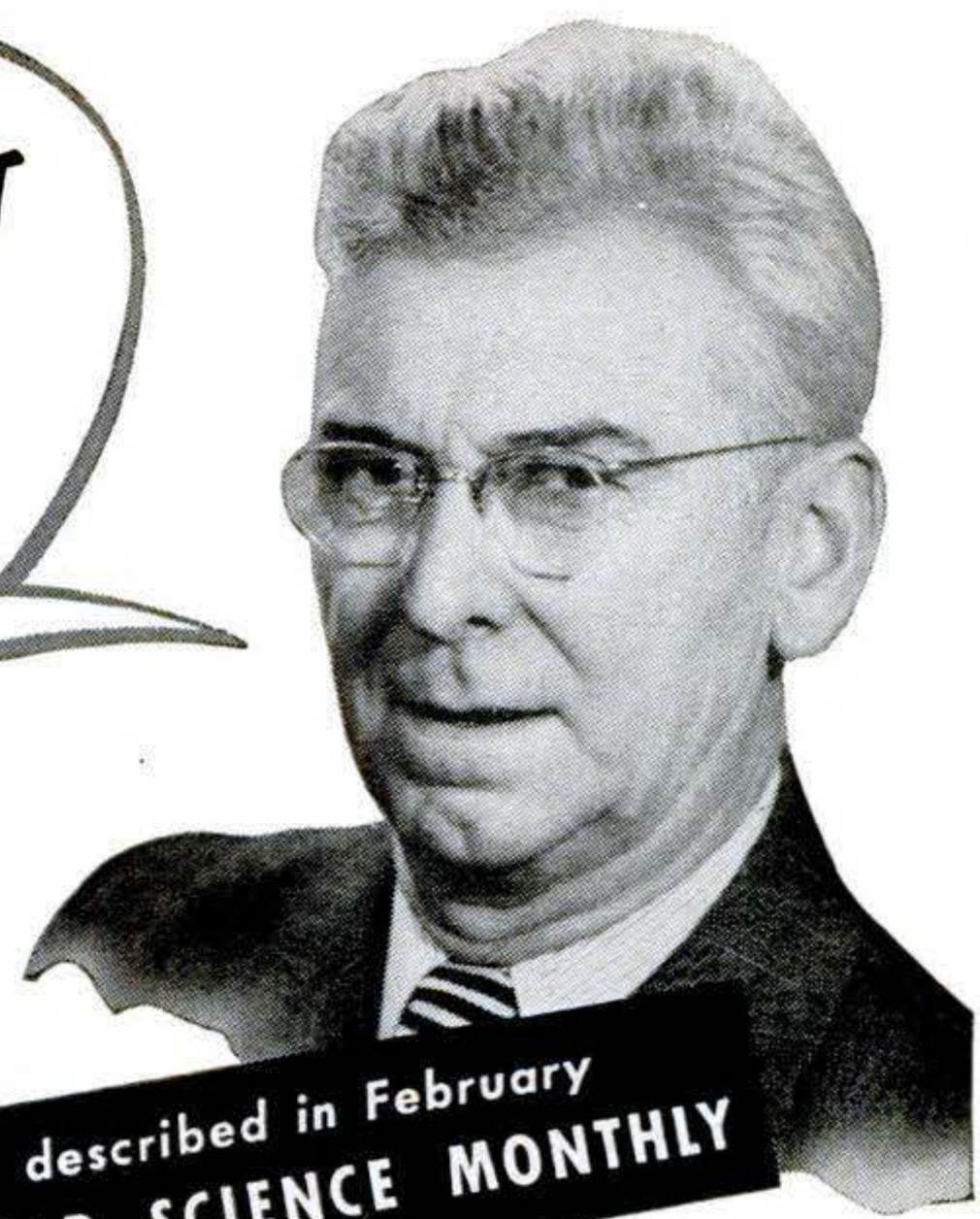
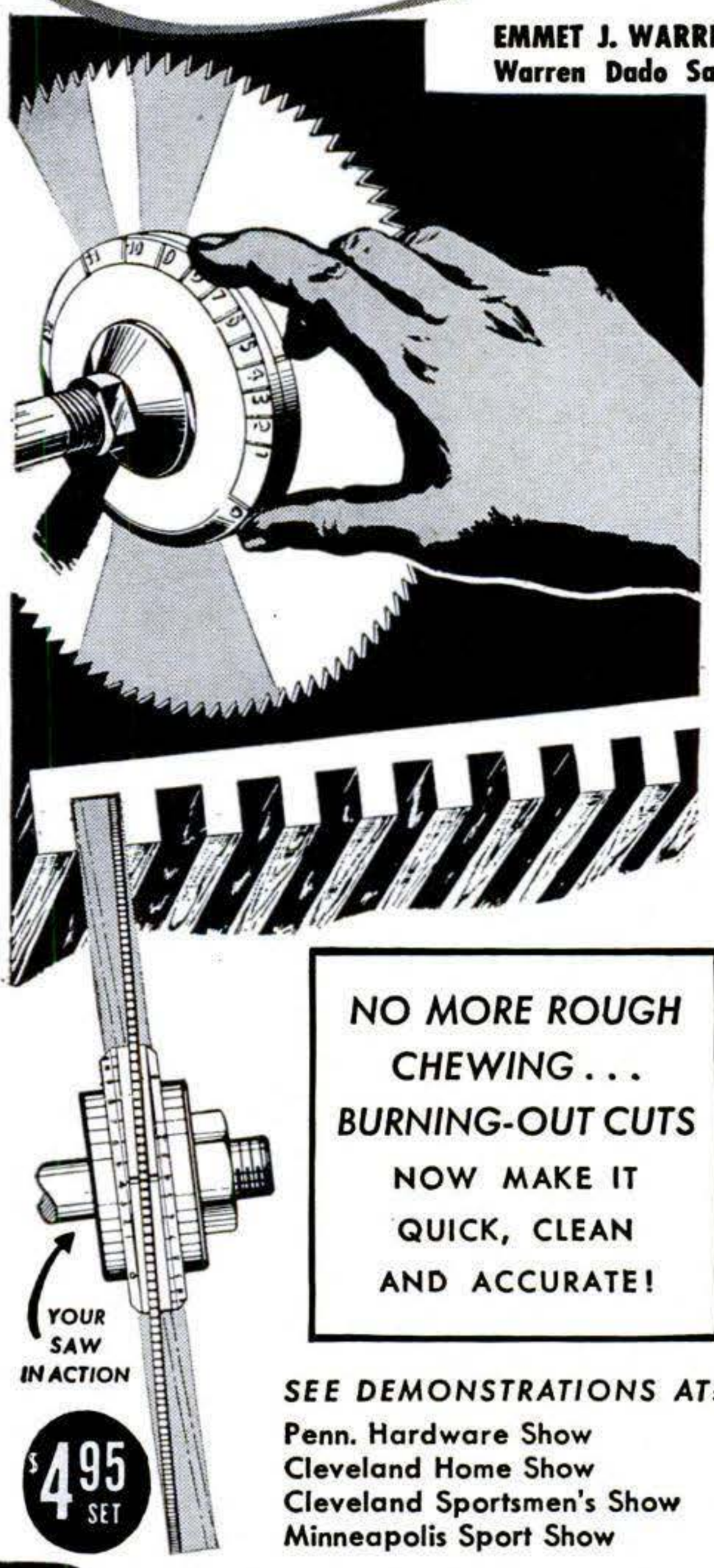


EMMET J. WARREN, Inventor of Warren Dado Sawing Washers



As described in February POPULAR SCIENCE MONTHLY

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Yes, woodworkers, I too became impatient with clumsy, old-fashioned dado equipment. After years of research and experiments I have created my Warren Dado Sawing Washers. With these four scientifically engineered, simple washers and your saw blade you can make clean, accurate dados or grooves in 12 different widths at any angle! Think of it—no more chewing and burning cuts, no more sanding—just dial the width of cut you want with Micromatic adjustment and in 15 seconds you're making that cut—quick, clean and smooth! It's truly the woodworker's delight. My washers come in 5 sizes to fit any arbor—½", ⅝", ¾", 1", 1⅛". See your dealer today or use my handy coupon below. And remember, my ironclad guarantee of complete satisfaction or your money back, goes with every set of washers.

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DADO SAWING WASHERS

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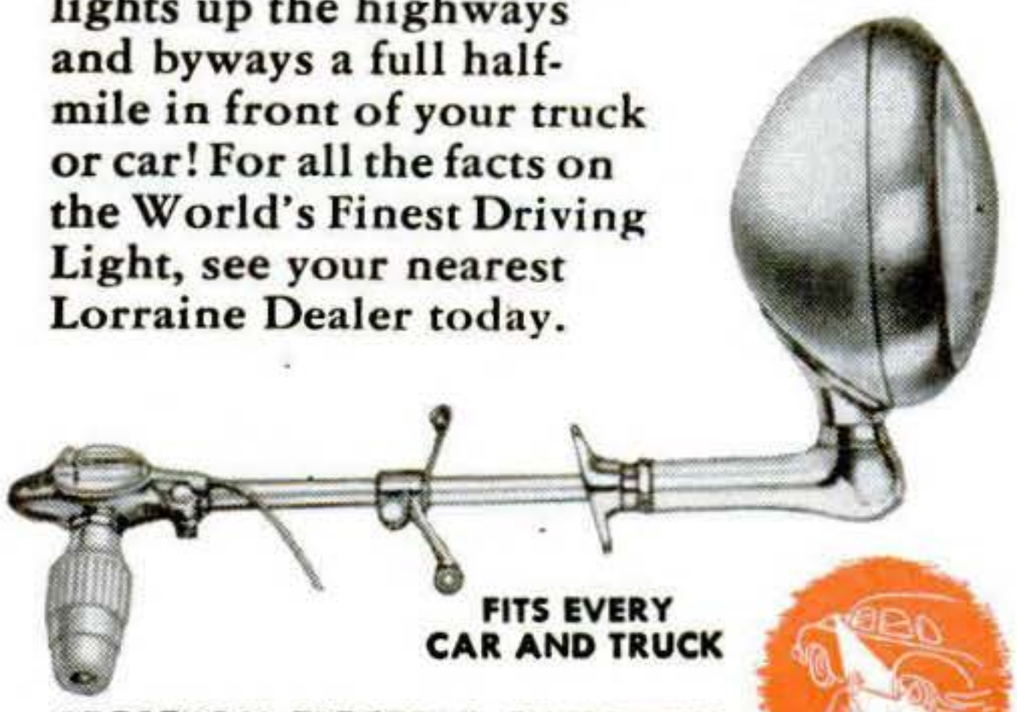

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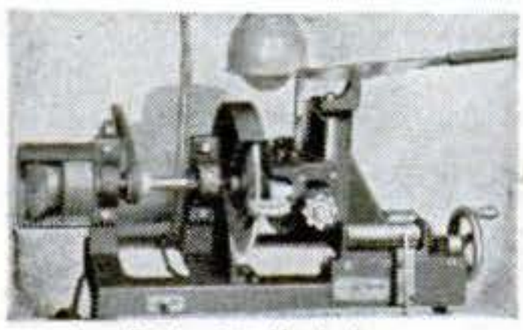

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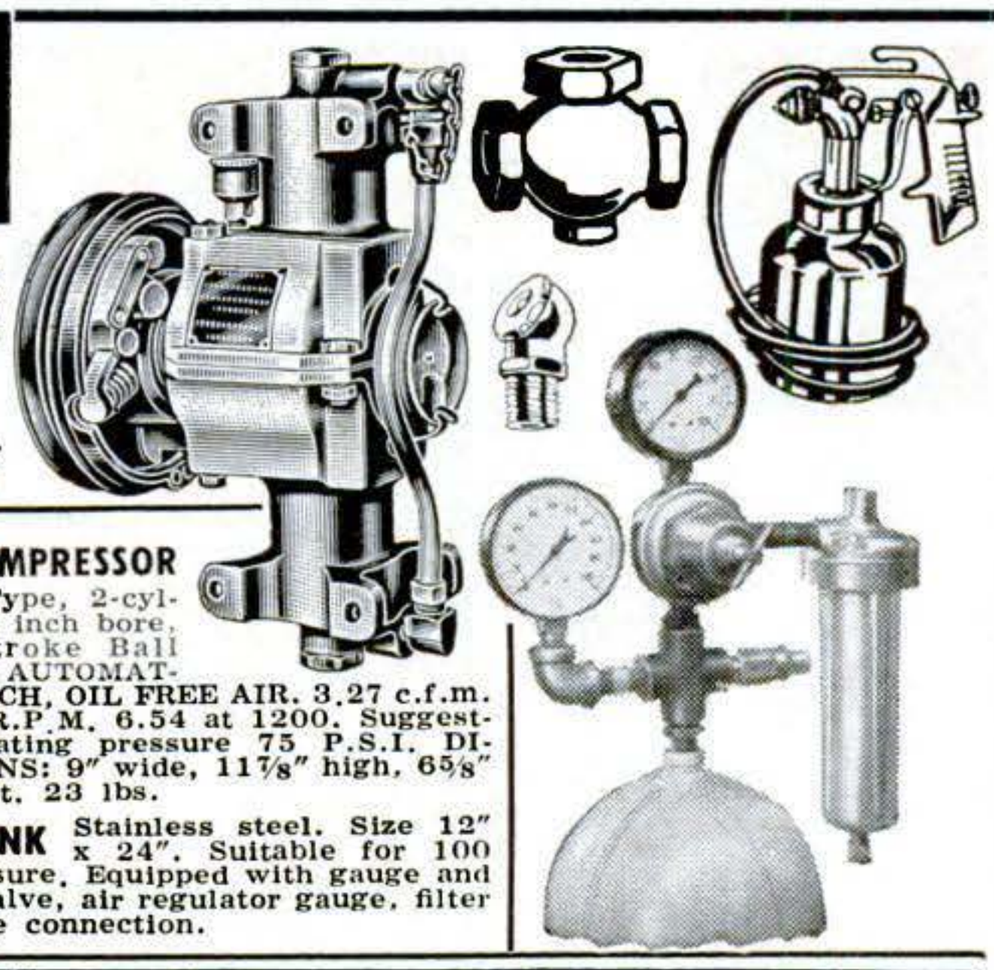

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Compressor separately, **$22.50**

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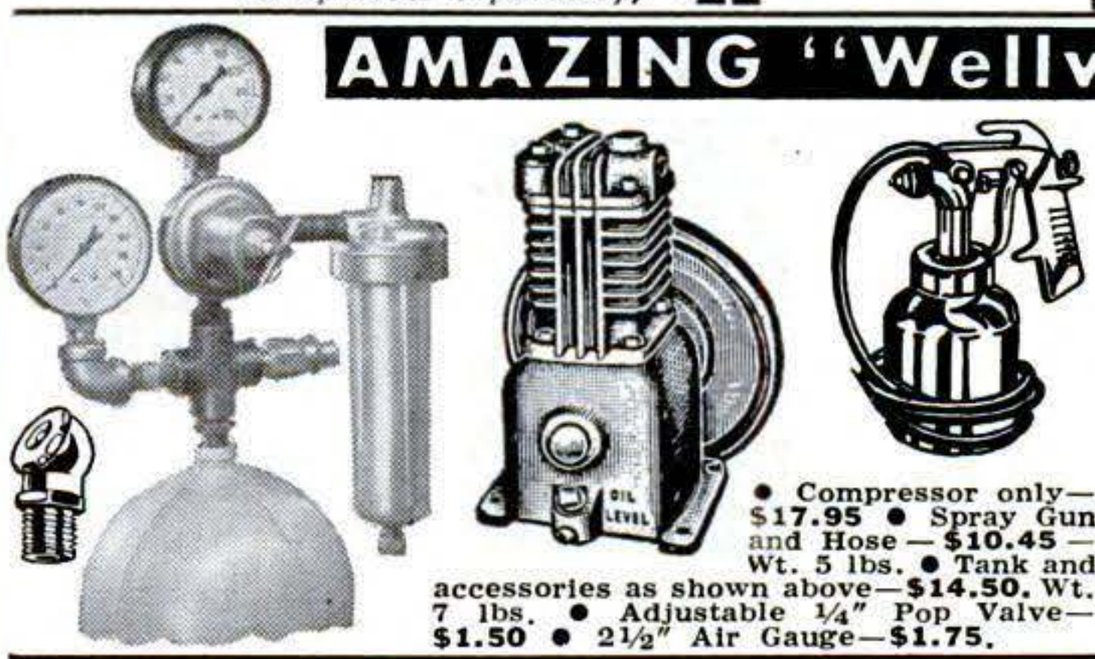
AIR TANK Stainless steel. Size 12" x 24". Suitable for 100 lb. pressure. Equipped with gauge and safety valve, air regulator gauge, filter and hose connection.

AMAZING "Wellworth" COMPRESSOR DEAL



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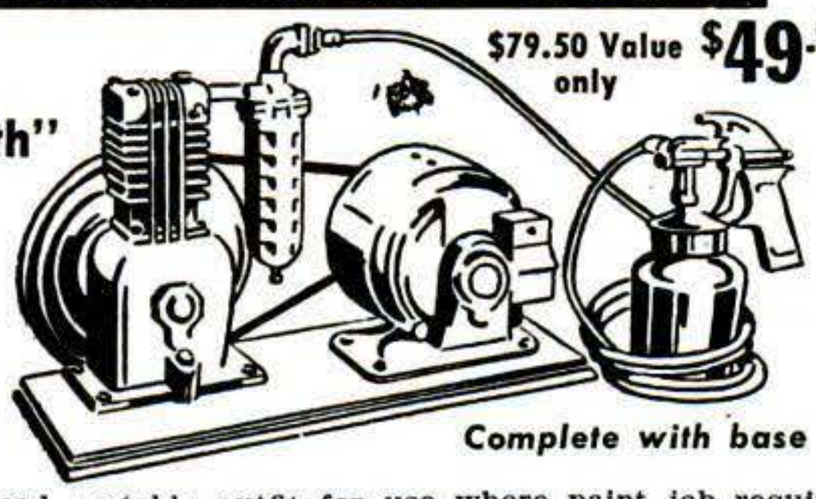
SENSATIONAL OFFER!

Complete outfit consists of compressor, pressure spray gun with 2 nozzles, pop valve, airchuck, 20 ft. hose, air tank and accessories as described. Complete for only $37.50

PORTABLE SPRAY OUTFIT

1/3 HP "Wellworth" ELECTRIC MOTOR DRIVEN OUTFIT

$79.50 Value only $49.95



Complete with base

Well balanced portable outfit for use where paint job requires larger quantity of material. Sprays all types of average viscosity paints, enamels, lacquers, varnishes, etc. Piston type, single cylinder air compressor, 2 in. bore by 1¾ in. stroke. Displacement 2.86 c.f.m.; maximum working pressure 40 lbs. Mounted on sturdy wood base with rubber feet. Pulsation chamber equipped with safety valve, drain cock. ⅓ H.P. G-E motor, 110-volt AC, cord and plug; 20 ft. air hose and fittings. Spray gun is pressure feed type, internal atomizing, with one qt. metal cup. Fan and round spray nozzle furnished. Shipping wt. 50 lbs.

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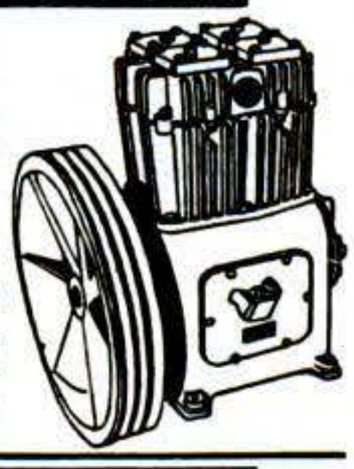
Size	c.f.m.	price	ship. wt.	motor required
2½ x 2½	12	**$102.05**	140	2 HP
3 x 2½	17.3	**113.75**	160	3 HP
3½ x 3	30	**153.85**	210	5 HP
4 x 3½	45.7	**246.55**	310	7½ HP

State if desired for automatic stop and start or continuous operation with constant speed unloader. Belts, pulleys, motors and gasoline engines available. Prices upon request.



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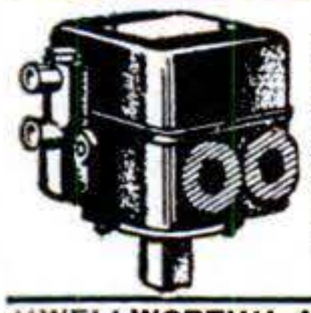

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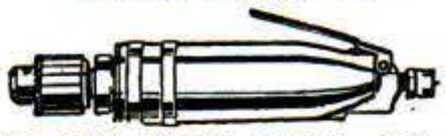

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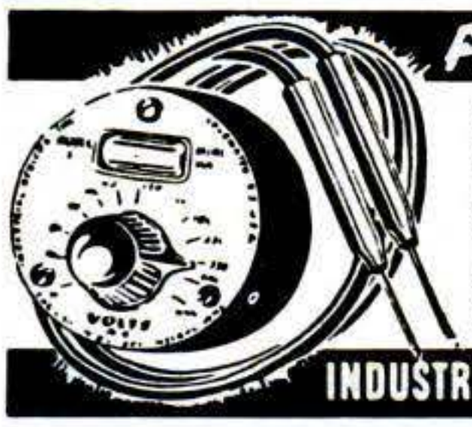

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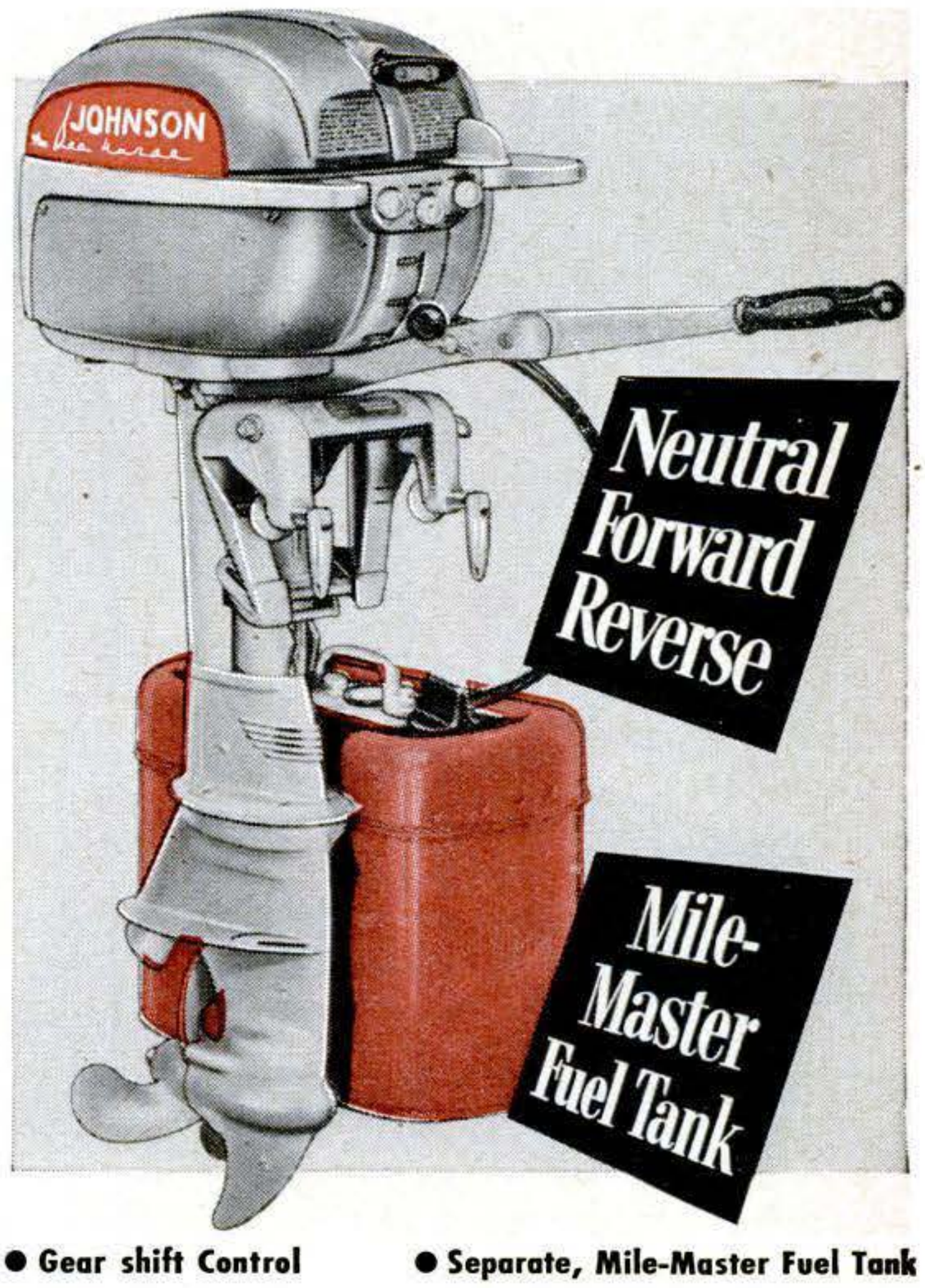

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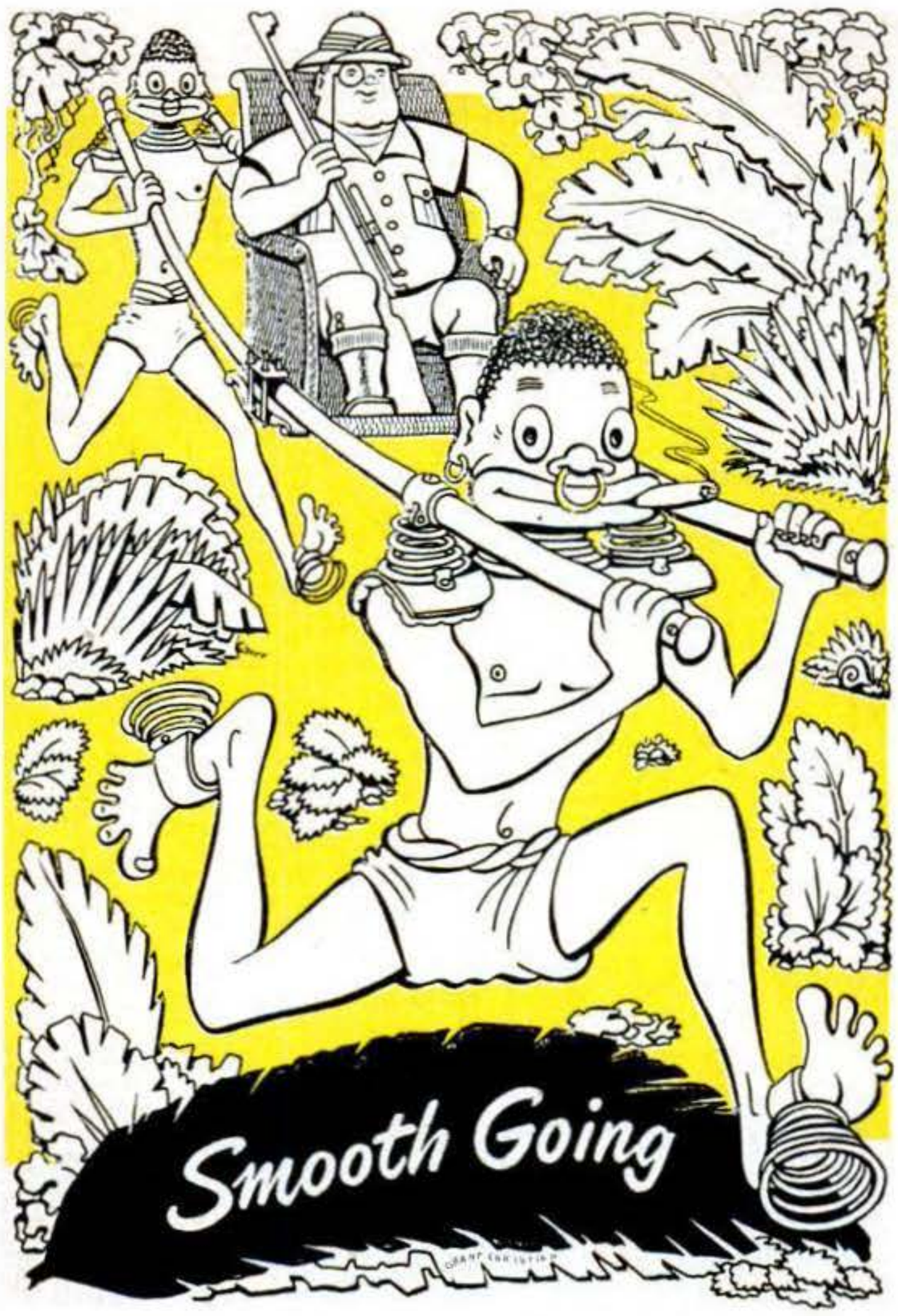

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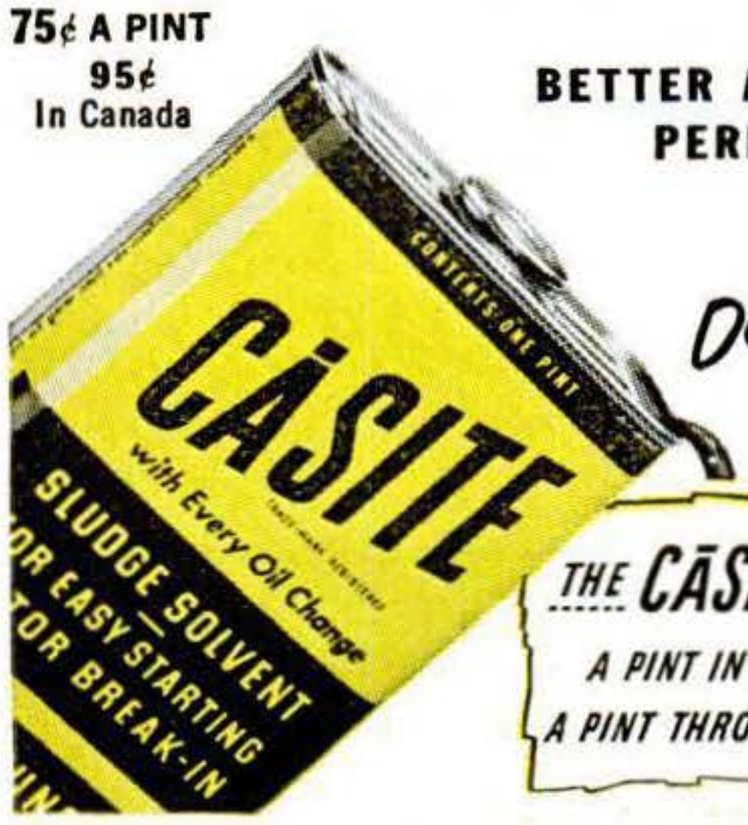

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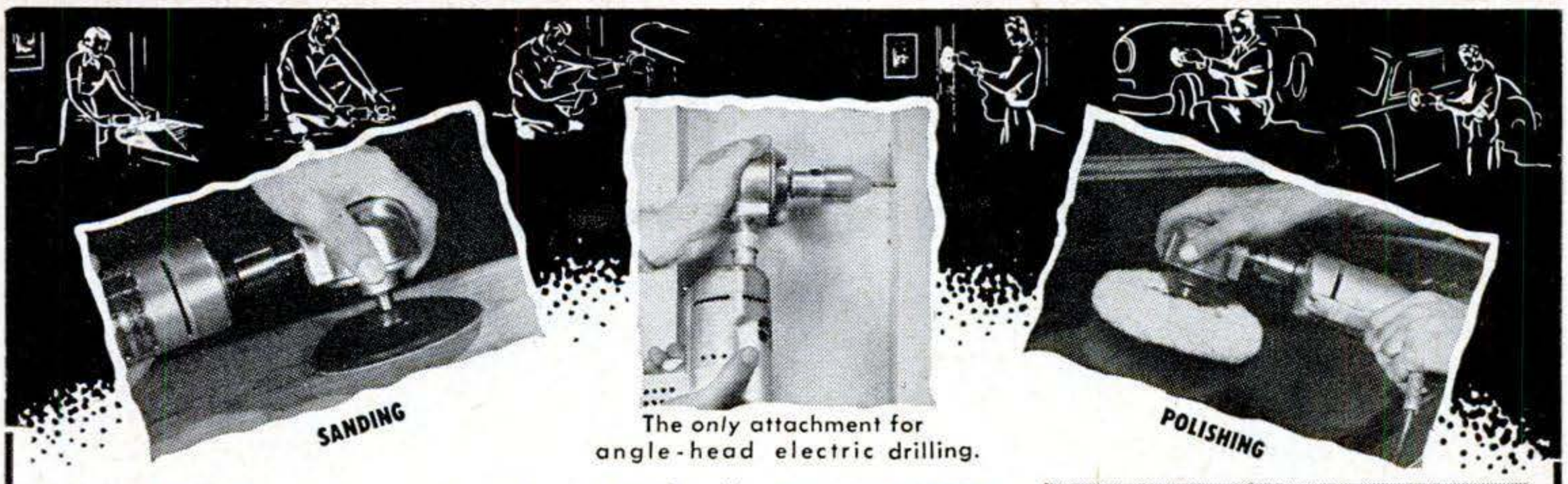

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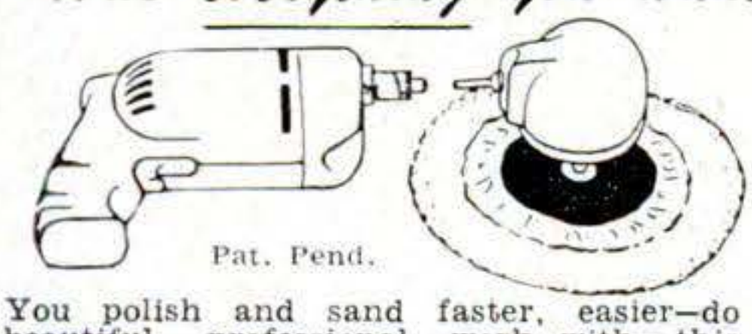

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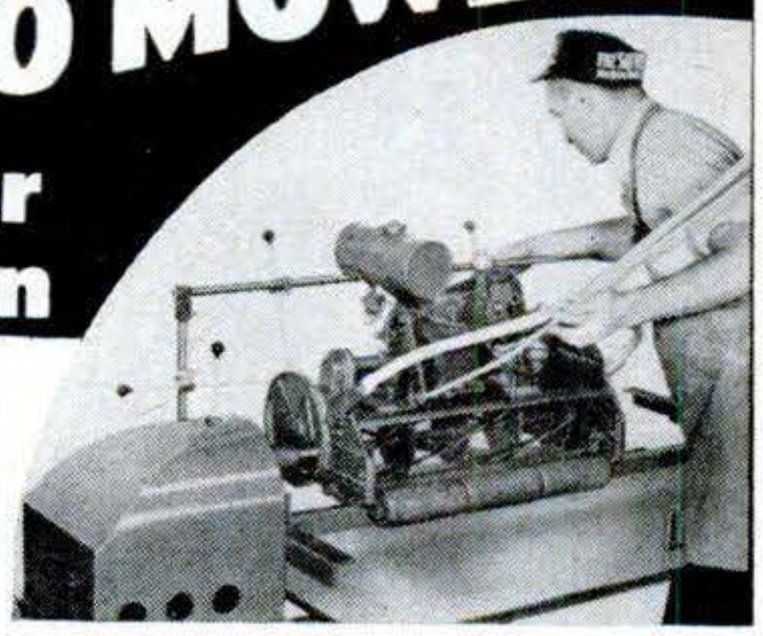

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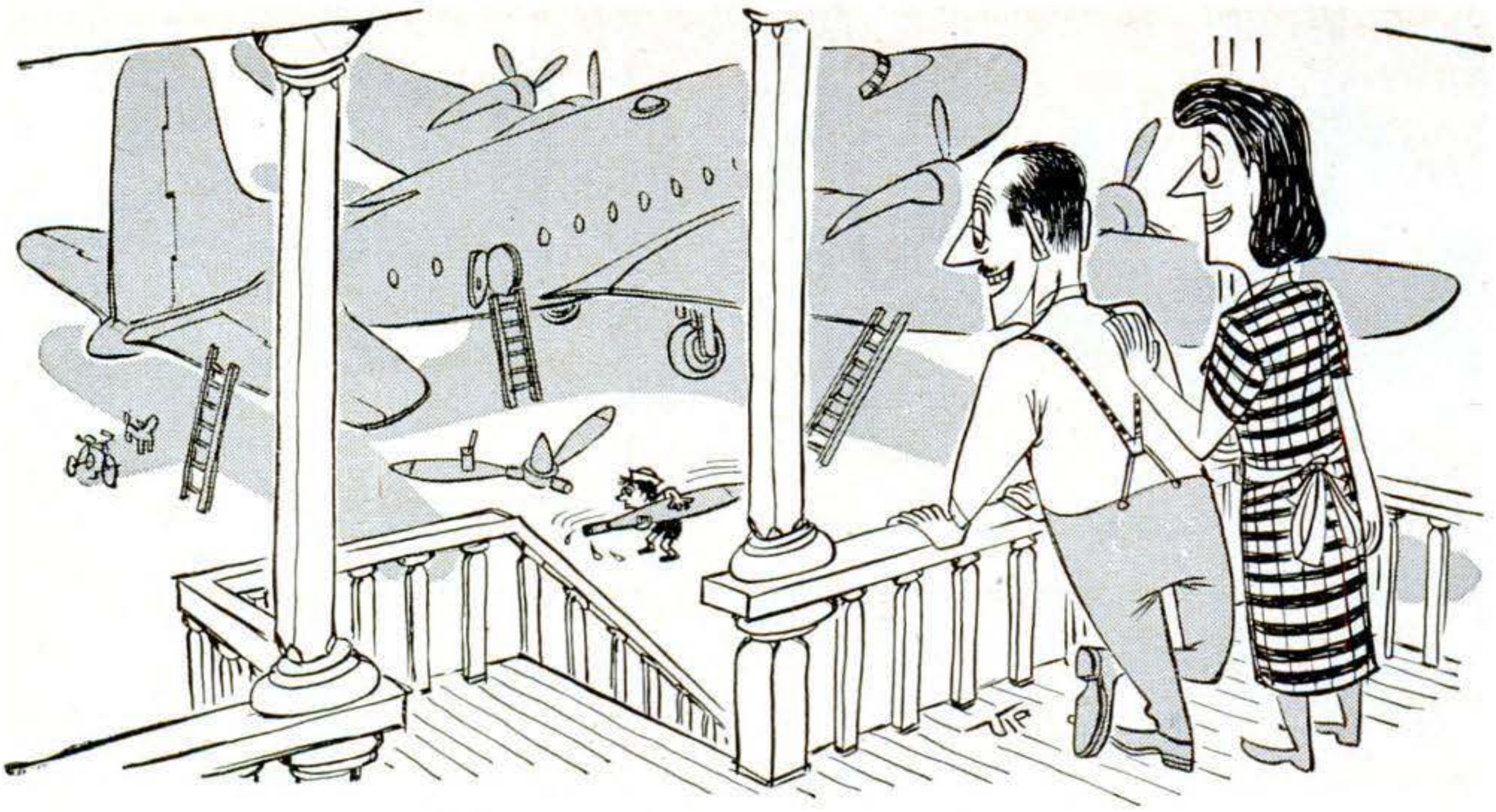

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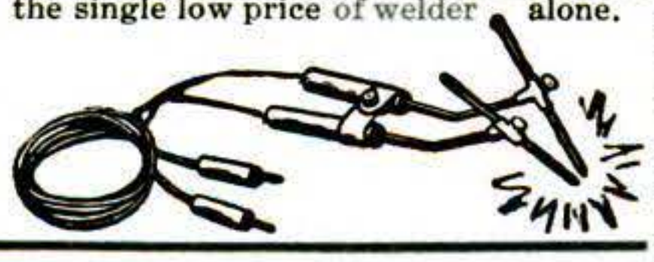

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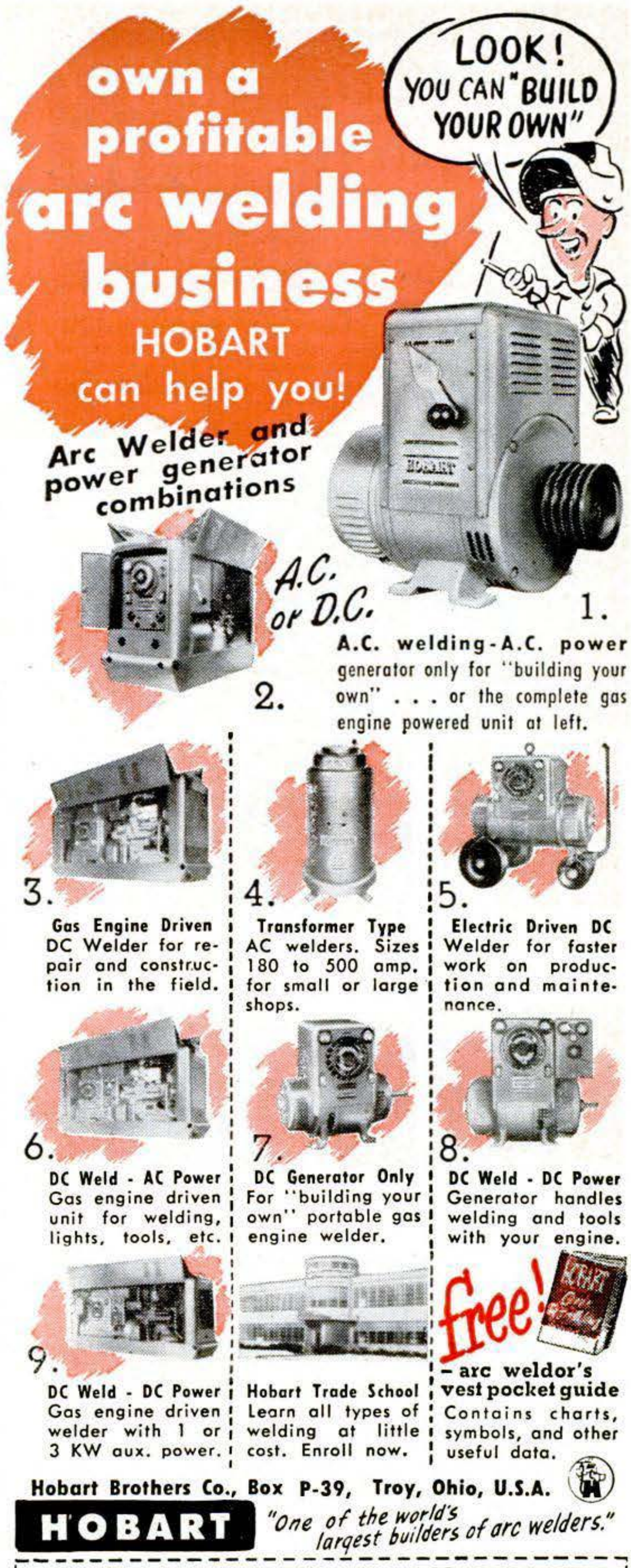

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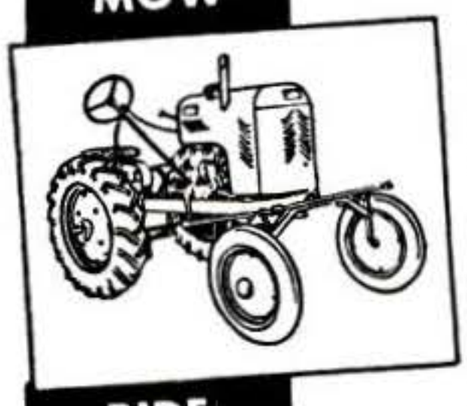

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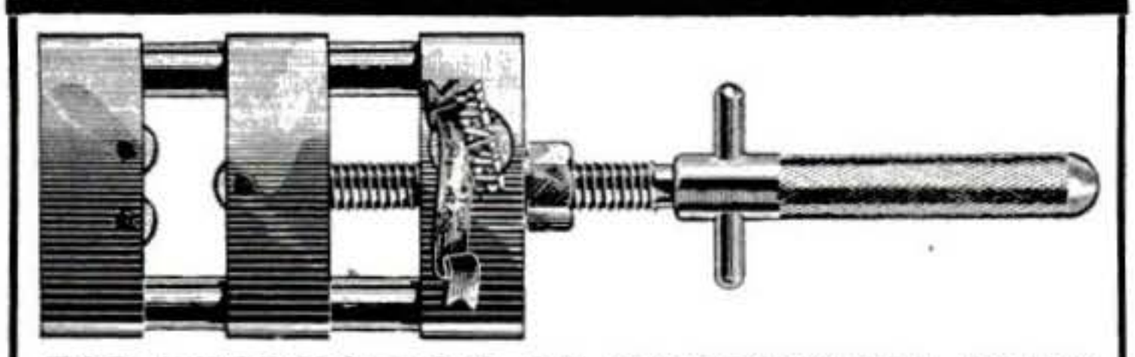

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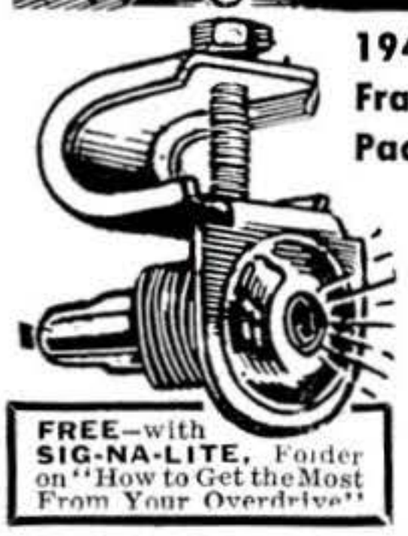

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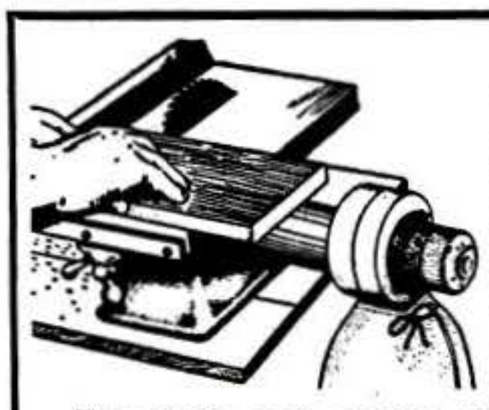

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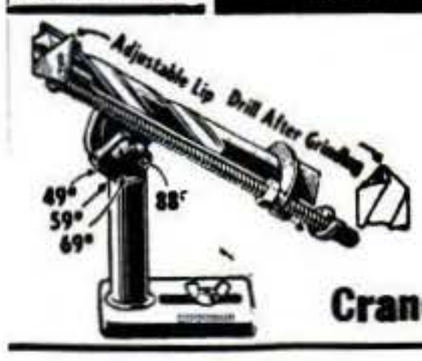

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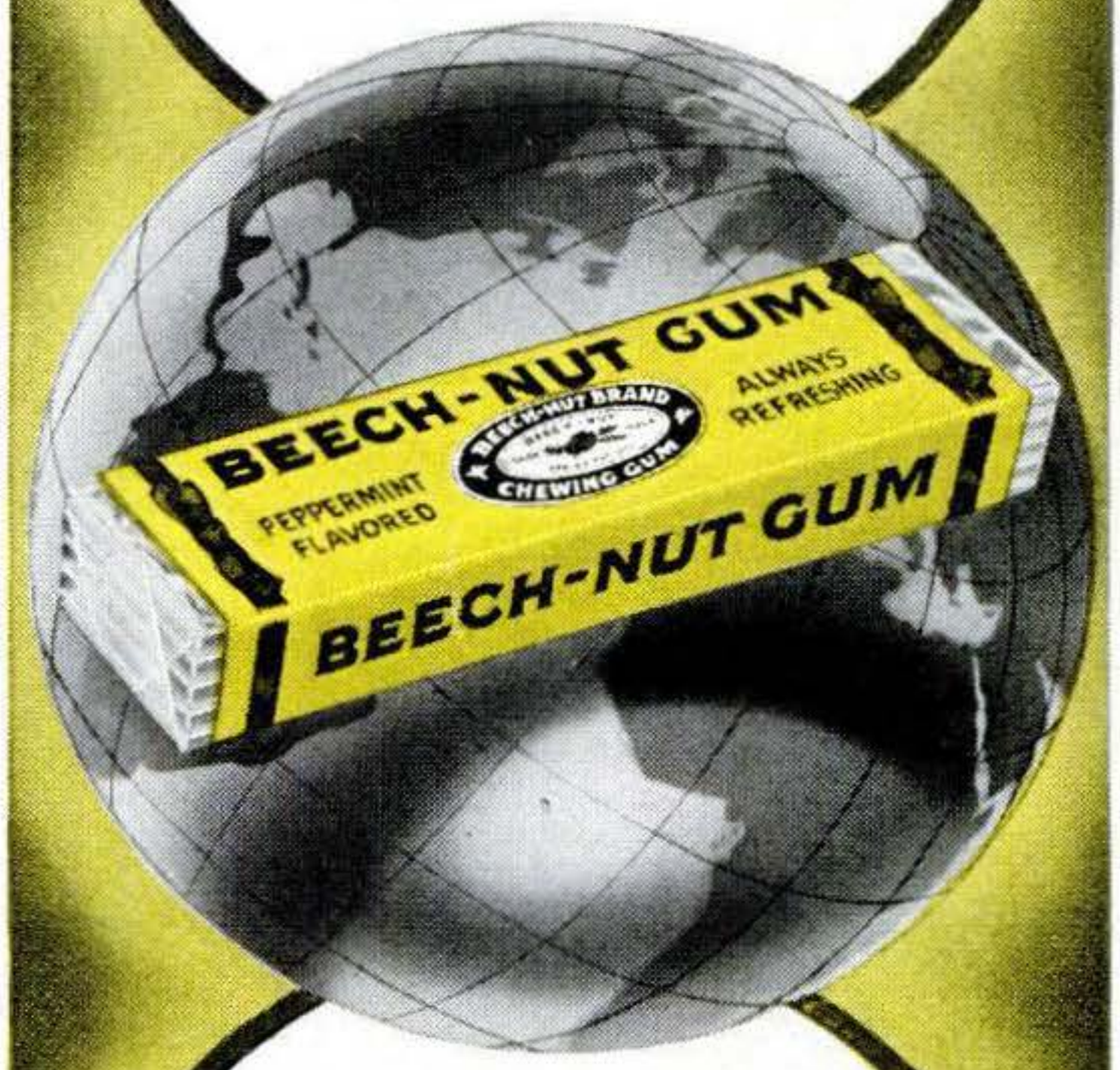

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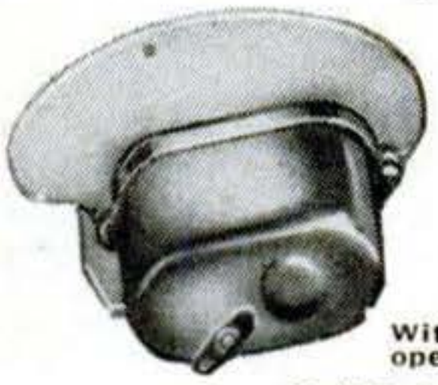

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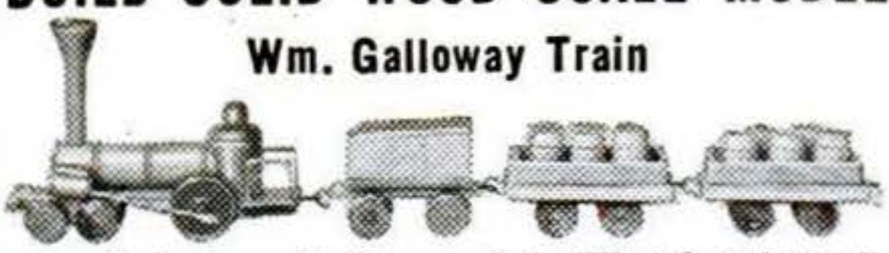

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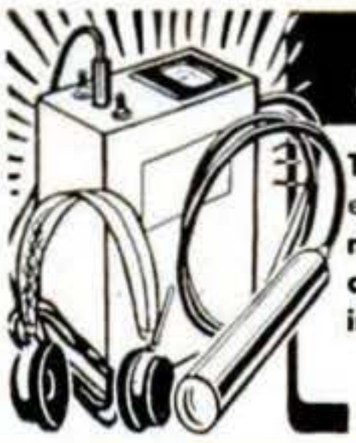

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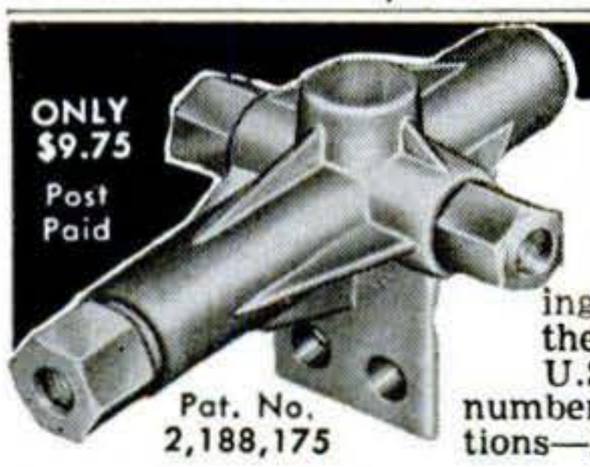

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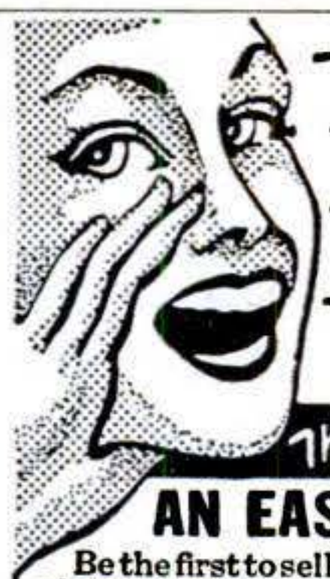

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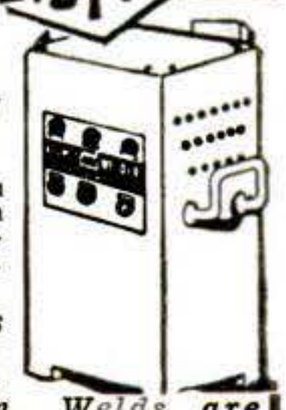

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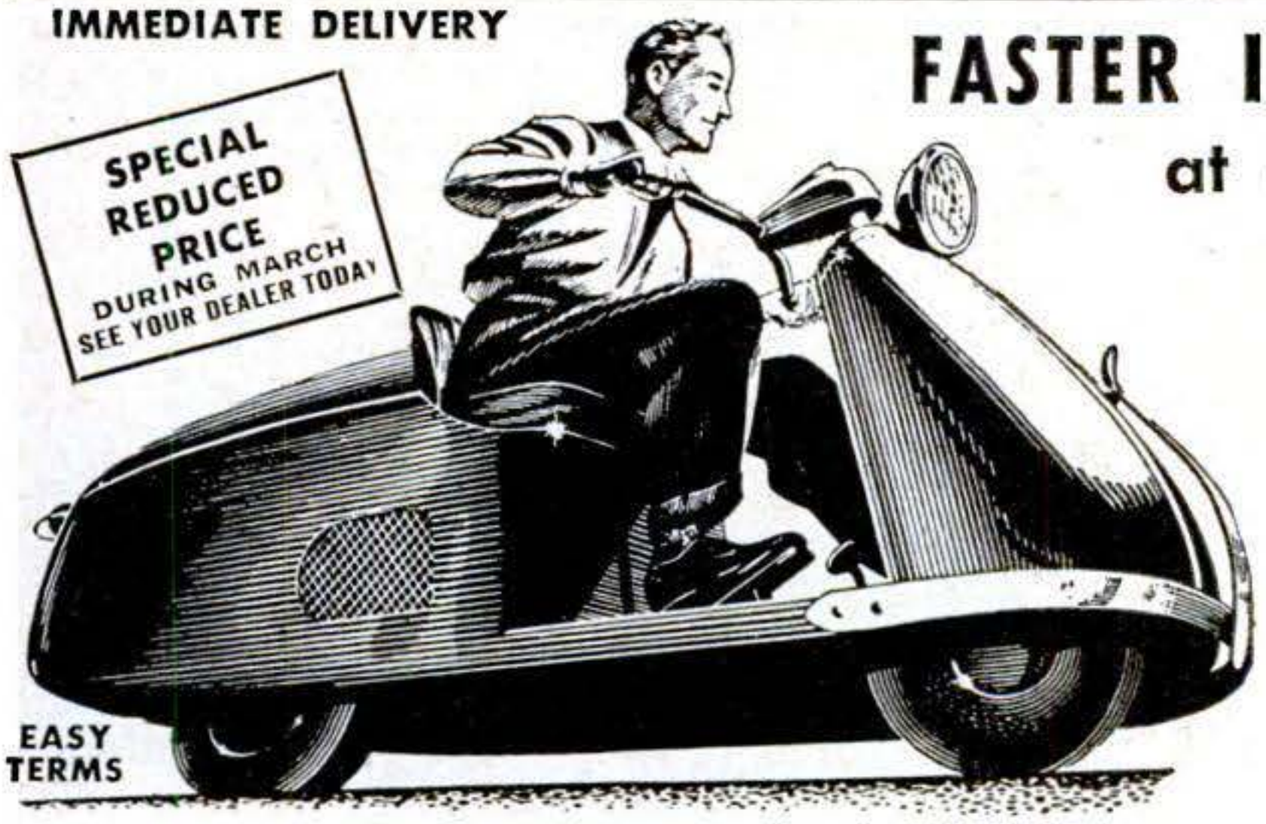

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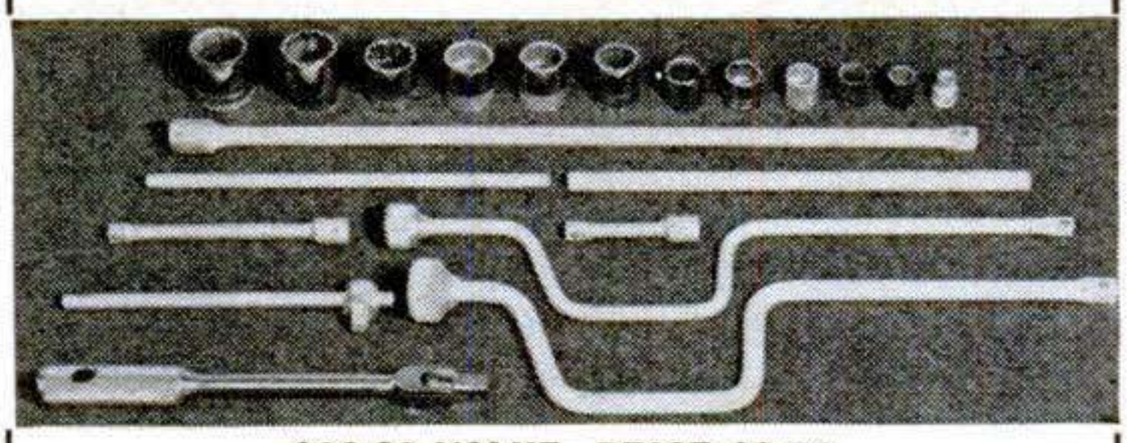
SOCKET SET



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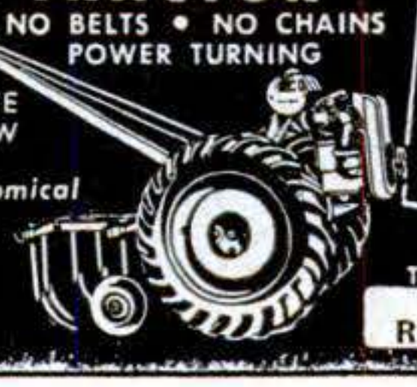

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Look for These Moto-Tool Features

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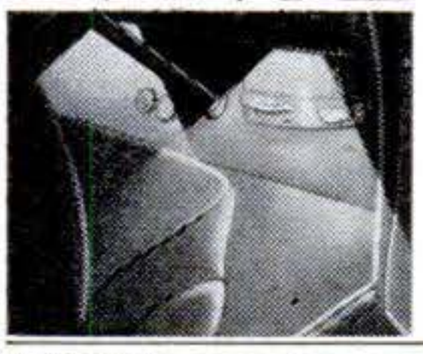

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Amazing MOTO-SANDER AND POLISHER

SAVES TIME—SAVES "ELBOW GREASE"

Here's a machine that takes the hard work out of two tough jobs . . . sanding and polishing. **"Moto-Sander"** is so easy to handle that a child can use it . . . so fool proof that, with it, even a novice can do a craftsman-like job. **Moto-Sander's** fast, straight-line action (non-rotary) eliminates any possibility of wood burns or scratches. Does a magically smooth job of sanding . . . gets into corners and places others can't reach. All **you** do is guide it! There are dozens of time and moneysaving uses in every home and shop for this inexpensive machine. Use **Moto-Sander** to get smooth sanded finish on furniture, painted walls, boats, bird houses, scale models, etc. Use it also for speedy, effortless **polishing** of waxed furniture, automobiles and other surfaces—simply by removing sandpaper and clamping on polishing pad. **Moto-Sander** is the lightest, most practical electric sander on the market—**the only one of its kind.** Furnished with 6 assorted sheets Garnet paper for sanding . . . plus **felt pad** and **sheepskin** for wax polishing. Operates on alternating current. Thousands of satisfied users.

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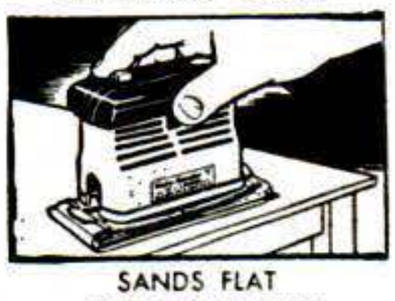
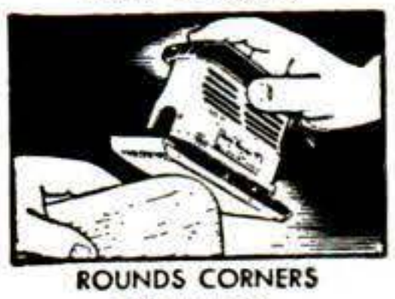


SANDS FLAT SURFACES EVENLY

GETS INTO TIGHT CORNERS



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USE MOTO-SANDER AROUND THE HOUSE

- **Sand Furniture and Woodwork**
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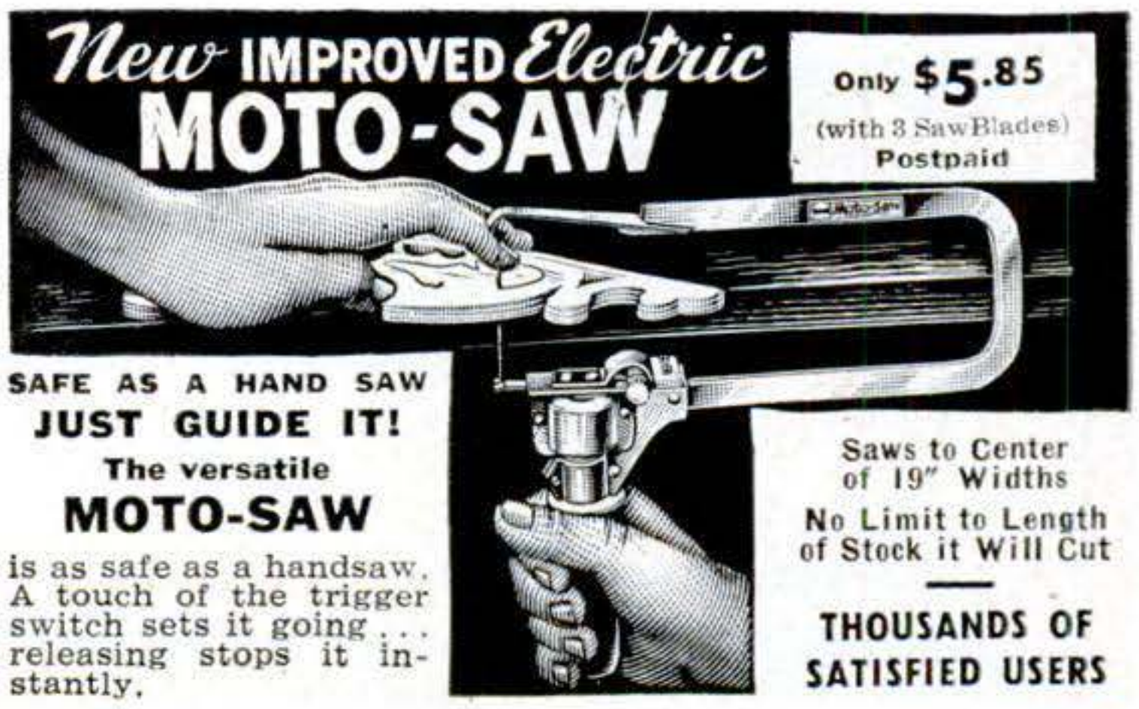
Only $5.85 (with 3 Saw Blades) Postpaid



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JUST GUIDE IT!
The versatile
MOTO-SAW
is as safe as a handsaw. A touch of the trigger switch sets it going . . . releasing stops it instantly.

Saws to Center of 19" Widths
No Limit to Length of Stock it Will Cut

THOUSANDS OF SATISFIED USERS

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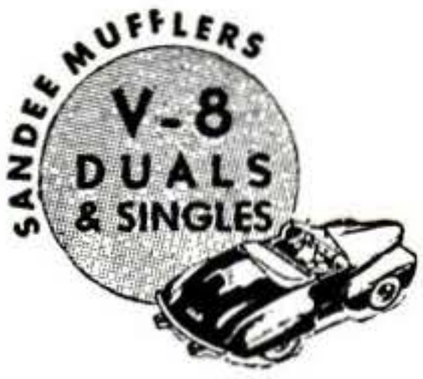

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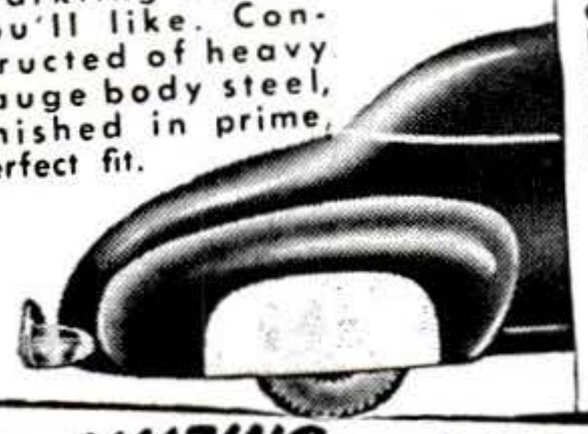

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for AMAZING acceleration

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DUAL INTAKE MANIFOLDS for V-8 FORDS AND MERCURYS

$15.00

Gas Line and Throttle Kit $2.50 extra
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By test: Increased acceleration by 26%—increased power and speed by 11%.

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DOES THE WORK OF 6 TOOLS IN 1
Holds 20 times its weight in water

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"Enclosed find 56 orders representing 9½ hours work on Monday and Tuesday." "Enclosed are 12 orders secured after supper this p.m."

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SHEET METAL PLIERS. 2½" wide, $2.00; 5", $3.50.

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NOBODY BUT NOBODY CAN BEAT THIS VALUE!

This low price is possible only because **WE MANUFACTURE & SELL DIRECT TO YOU!**
CHECK THESE FEATURES: 2" HARDWOOD, GLUED & DOWELED TOP. Bins for parts. Tool rack. 1" bottom shelf with back brace. Spacious drawer. 23-60x32" high. Wt. 100 lbs. Shipped KD with bolts, nuts. Specify Railway Exp. or Rail Freight del. FOB Yonkers.

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Gear Head MOTOR

Holtzer Cabot 110 volt AC 60 cycle. Can be used for turn tables, telescope drives, etc. Approx. 1/20 H.P. Output shaft — 50 RPM. **Stock #406....New only $14.95**

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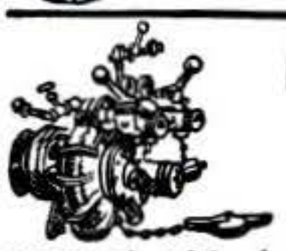

For fire depts., factories, forest fire protection, etc. 600 gal. per min. Can be operated with 4 or 6 cylinder gas engine. 4½" intake . . . 2—2" outlets . . . 265 ft. head at 120 lbs. pressure. Passed by National Board of Fire Underwriters. **NEW. Stock #407..... $175.00**

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Good for water, oil, air, etc. Will stand 75 lb. pressure. Available in 50, 100 ft. or more lengths.

⅛", 3/16", ¼" (your choice) per foot	2c
5/16", ½" (your choice) per foot	3c
9/16", ⅝" (your choice) per foot	4c
¾", 1" (your choice) per foot	6c
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Portable BUZZ SAW

Powered by 6½ HP Briggs & Stratton air cooled gas engine. Adjustable hinge, requires no clutch. 28" blade, will take up to 12" hardwood. 1⅜" ball bearing mandrel. Has power take-off. Complete unit mounted on two wheels with 400 x 8 pneumatic tires. Has tow bar for trailing. Wt. approx. 400 lbs. Sold complete or less blade, engine or wheels. Make $25 to $50 a day sawing wood with this sturdy unit. **Write for free Circular. Stock #350.**

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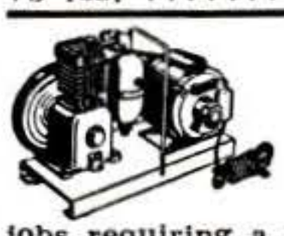
Complete, piston type with 10 gal. tank, ⅓ HP capacitor type, AC. 110-220 volt 60 cycle motor. V-belt drive. Will develop 75 lb. pressure—approx. 2 cu. ft. Brand new. **Stock #340.....Only $79.50**

Assemble yourself and save $10. ABOVE tank with legs and saddle..... **$11.95**

AS ABOVE—½ HP motor, 2 cyl. Westinghouse compressor. 3 c.f.m. at 75 lbs. **$109.50**

Portable AIR COMPRESSOR



Electric motor driven, portable spray painting unit for jobs requiring a larger quantity of material. Piston type, single cyl. air compressor has 2" bore by 1¾" stroke. 2.86 CFM. Max. working pressure 40 lbs. Mounted on base. Equipped with safety valve & drain cock. ⅓ HP capacitor type motor. 110 volt AC, with cord and plug. 20 ft. air hose and fittings. Ship. wt. 45 lbs. Brand new. **Stock #348 .....only $42.50**

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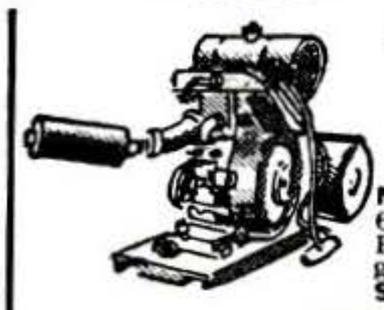
Kellog Model 241 air compressor. Piston type with 2" x 1¾" bore. Capacity of 2.8 CFM at 100 lbs. V-belt drive. ¾" shaft. Can be run with ⅓ or ½ HP motor. Delivers oil free air. Max. recommended working pressure 150 lbs. **Stock #349. NEW.....only $14.95**

AC ARMY LIGHT PLANTS



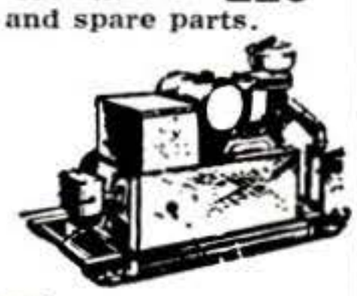
New 750 watt 110 volt, 60 cycle light plant with Briggs-Stratton model AP gas engine. **Stock #315. $149.50**

New 1000 watt 110 volt, 60 cycle light plant with Briggs-Stratton model BP gas engine. **Stock #316..... $179.50**

New 2500 watt 110 volt, 60 cycle light plant with Briggs-Stratton model Z 6 HP gas engine. **Stock #317. New $265.00 Used,** like new **$225.00**

Add $10 for tools and spare parts.

Rebuilt 5000 watt 110 volt, 60 cy. light plant with automatic remote control. Powered by Jeep 4 cyl. gas engine. Rebuilt like new and guaranteed. **Stock #318 .... $ 625.00**



7,500 watt, 110 volt AC light plant powered by VE-4 Waukesha 4 cyl. gas engine. Continental or Hollinsworth generator. Remote control starting with 100 ft. starting cable, and 100 ft. of 3 wire #6 cable. Complete switch board. Used, like new. **Stock #347 ..... $675.00**

Add $65.00 for transformer to make plant 3 phase, 220 volt.

10,000 watt 110 and 220 volt, 60 cy. light plant with automatic remote control. Powered by Jeep 4 cyl. gas engine. Rebuilt like new and guaranteed. **Stock #319 ..... $900.00**

PORTABLE DC LIGHT PLANT

3000 watt 110 volt DC powered by new 6 HP Briggs-Stratton model ZZP gas engine. Rebuilt generator. Generator alone lists at $243.00. Has volt meter, rheostat, 4 female plugs, and ball bearing 2.75 x 10 rubber wheels. Guaranteed. **Stock #320.....only $185.00**

SPECIAL!

300 watt, 110-220 volt A.C. 60 cycle light plant powered by 1¼ H.P. gas engine. Mounted on base. **Stock #409**

New ..... only $99.50

GENERATORS

AC—750 watt 110 volt 60 cy. with voltmeter, rheostat, ¾" shaft. Dimensions: 9"H x 12"W x 13"L. Wt. 52 lbs. Shielded to prevent radio interference. Mfg. by Elcor. $125.00 value. **NEW. Stock #322. OUR PRICE..... $69.50**

AC 1000 watt— Stock #403..... $79.50

DC-300 watt, 12 volt, 2900 RPM, heavy duty, with current cut-out relay, high and low switch, 30 amp meter. Can be bought less shaft and base to be used direct mounted to Briggs-Stratton 1 HP engine. **NEW. Stock #323..... $7.00**

Complete with base, shaft and bearing. **NEW. Stock #324..... $15.95**

Horns and Howlers

Motor driven, (not a vibrator). Heavy duty with great power and long life. Adjustable for high, medium or low tone. 110 volt AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, etc. List price $47.00. **NEW. Stock #302. OUR PRICE $9.45**

Productimeter COUNTER

Manufactured by Durant. Readings up to 5 figures. Rotating drive shaft. **NEW, Stock #405 .....only $3.95**

HALF TON WAGON

"Assembled or in kit form"

Stock #332

Heavy duty wagon with plate aluminum body 24" x 42". ⅝" steel axle with ball bearing wheels. Heavy rubber tires. Ideal for newsboys, farms, grocers, parts dept., etc. Approx. wt. 88 lbs. Nothing like it now on the market.

WRITE FOR FREE CIRCULAR

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For kitchens, attics, basements, etc. 8" ball bearing fan Mfg. by Robbins & Meyers. Can be run vertically or horizontally, 110 volt AC 60 cycle motor with plug and cord. New in original box. **Stock #401 .....only $11.95**

ELECTRIC RUBBER CABLE

(all new)

CORD SETS

Extension cords, 100 ft. heavy duty. Plug, socket and guard. Number 16 wire. Worth at least $10. **Stock #310. OUR PRICE $5.95**

Same as above — 50 ft. length. **Stock #311..... $4.25**

Heavy Duty Electric Cable

3 wire #10 Super Cable, Stock #408

100 ft....$22.00 250 ft....$48.00

4 conductor neoprene covered # 18 stranded tinned copper wire (two blacks & two whites). Run in parallel gives you #16 gauge. Lugs furnished for parallel run. Water & oil resistant. **(Stock #346)**

100 ft.	250 ft.	500 ft.	1320 ft. reel
$4.25	10.00	$19.00	$36.00

150 ft. reels, 3 wire #6 with 4, 60 amp Crouse & Hines connectors—2 male & 2 female. Perfect for welders, hay loaders, saws, electric ranges, etc. List price $190 per reel. **Stock #313. OUR PRICE $65.00**

BALL BEARING ARBORS

Grinding and saw arbor, has ½" double end shaft, 11½" long with 2" center pulley. New Departure double roll ball bearings. Right and left hand thread. Self aligning Dodge pillow block. 10,000 RPM. Bearings alone list at $10. Complete arbor new. **Stock #305 .....only $4.95**

HI-SPEED GRINDER (not pictured). Has 2 step pulley driven thru rear or base. **Stock #328 ..... $10.95**

CLUTCH

for motor-scooters, motorbikes, lawn mowers, etc.

Mercury centrifugal clutch for use with any small gas engine. 3" "A" belt pulley, ⅝" bore. **Stock #400. Brand new....only $9.95**

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WITH 2 EXTRA REFILLS

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PRICE—$1.00 COMPLETE WITH 2 EXTRA ABRASIVE CLOTH REFILLS!

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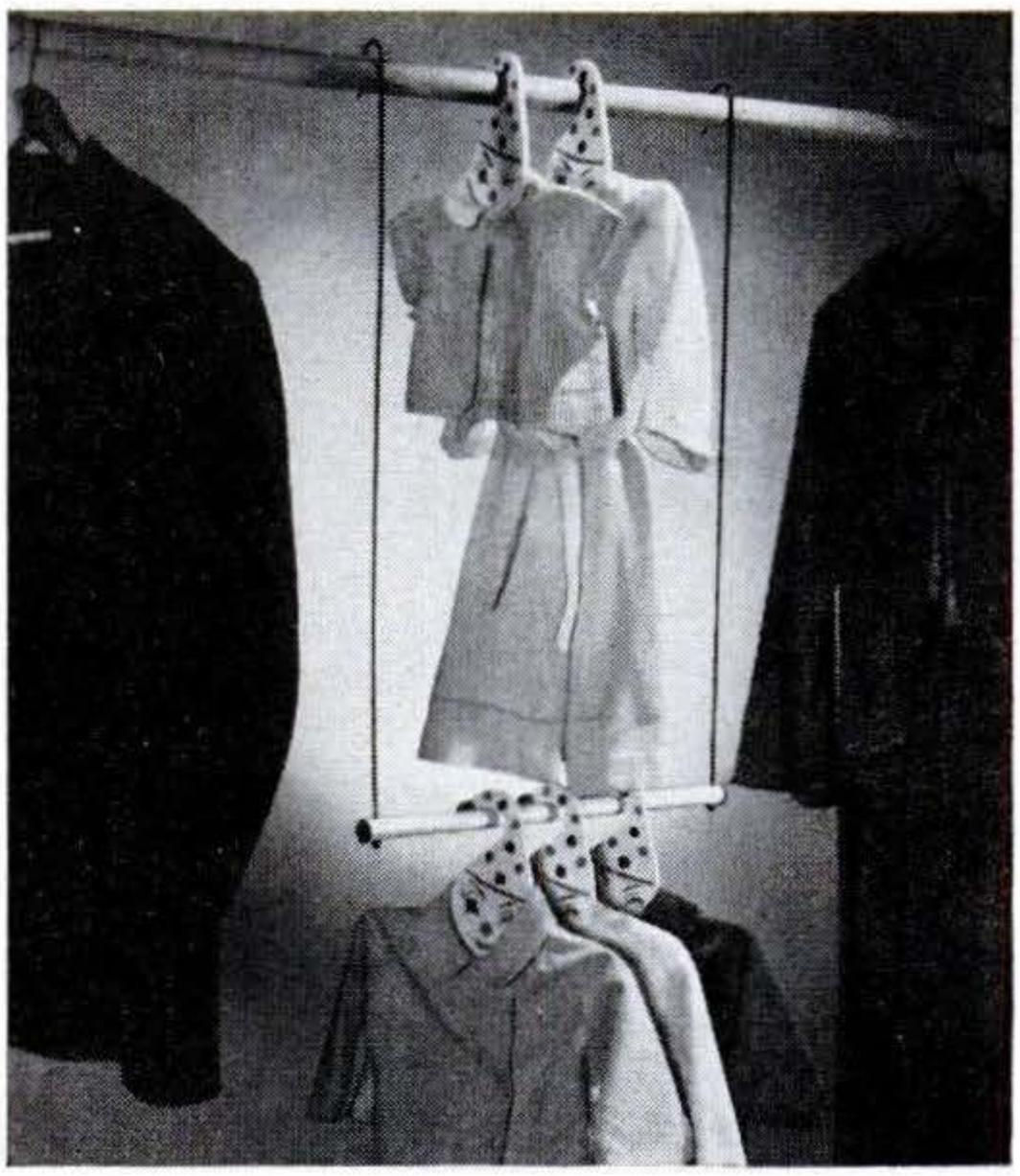

Hanger Adds to Closet Space. Storage room for children's clothes is doubled with this hanger sold by Nursery Plastics, New York City. The rod is cellulose acetate over a hardwood dowel with the vertical pieces in a contrasting color.

Mattress Keeps You Warm. An electrical heating unit maintains this mattress at a comfortable temperature, according to the Sylcon Corporation. The heat is concentrated in the area of the feet and legs. The price is $60 and up.

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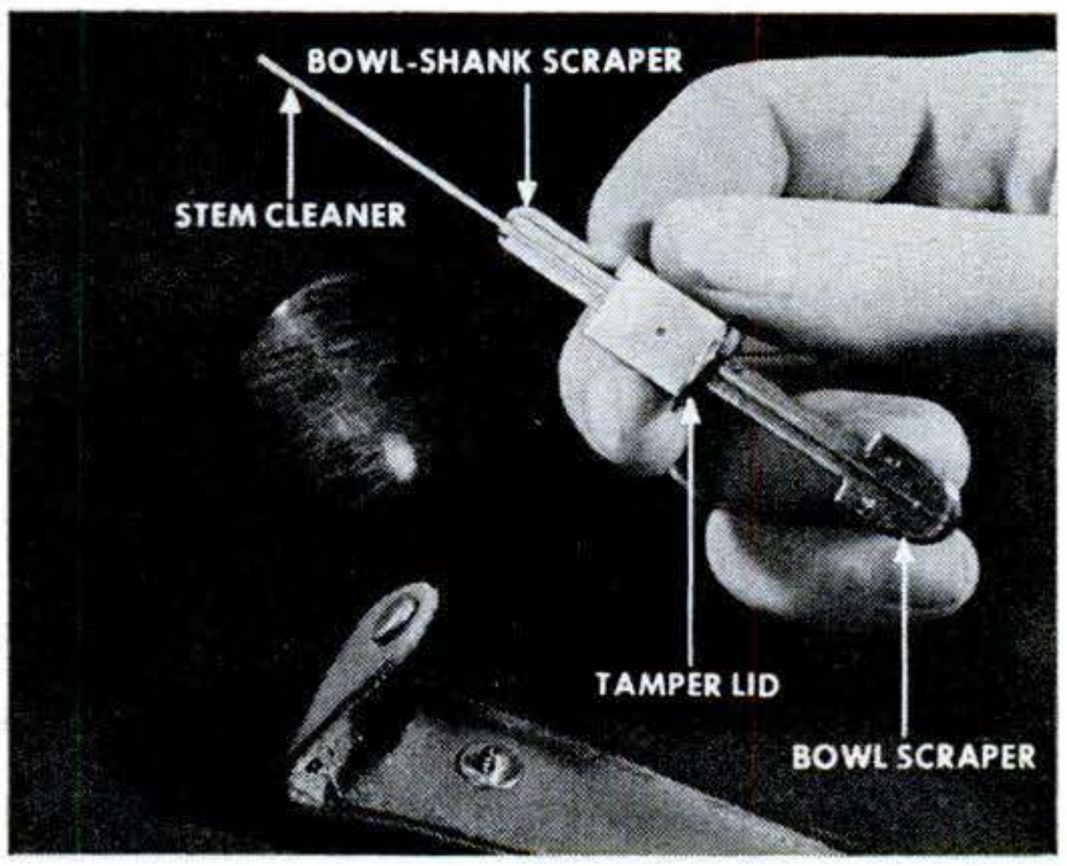
Modern Living

Rack Up Your Ironing. Two chrome-plated rods, connected at right angles, are clamped to any standard ironing board to support up to 12 pieces of clothing. Rods are disconnected for storage. Hufeld Engineering Co., Peoria, Ill., is the maker.



Gadget Cleans Pipes. The spade-shaped end reams out the bowl and the other end is used to clean the stem. At the end of the forefinger in the photo is a section that reams out the shank. The maker is Fred Wacker Co., Long Island City, N. Y.

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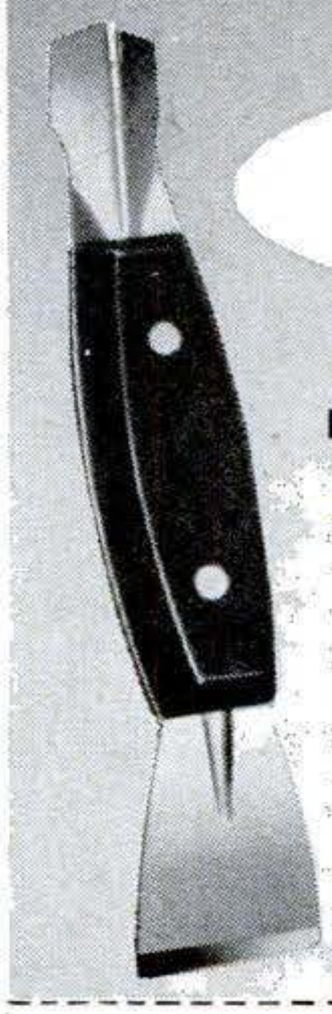
with the
DUO-FAST PUTTY KNIFE



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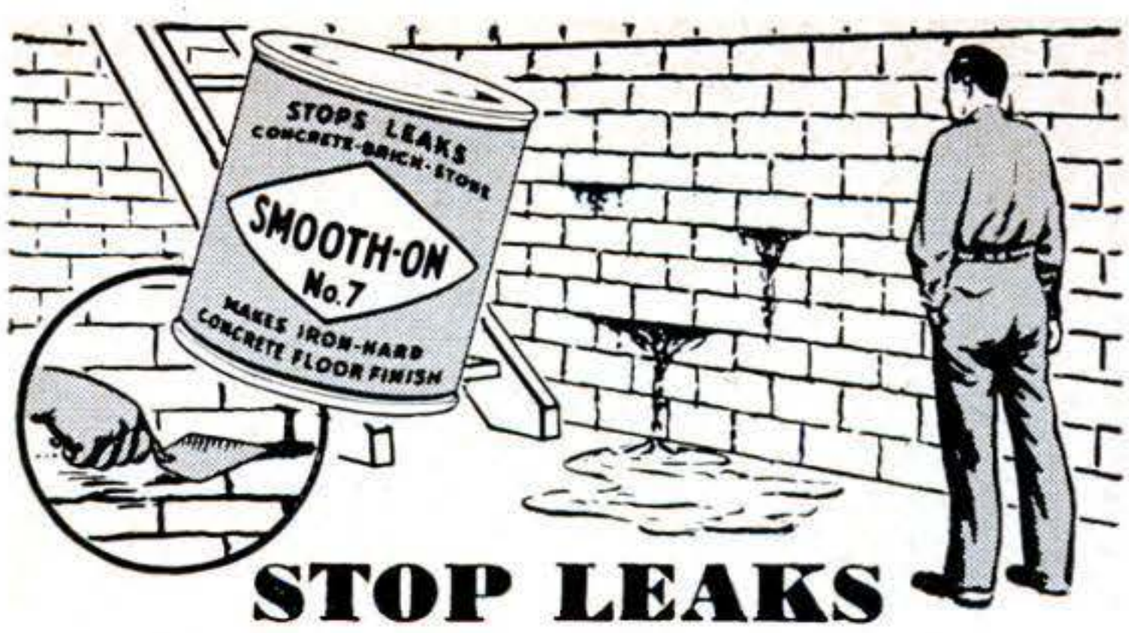

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LETS YOU HEAT ANY ROOM INDIVIDUALLY AT THE MOST COMFORTABLE TEMPERATURE.

Replaces ordinary air valves. Radiator heats only when temperature drops below valve setting and shuts off vent when setting is again reached. May be installed in one-pipe steam system.

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A **must** tool for electricians, maintenance men, home owners. **Replaceable** lamp inside Plier tests 110 to 250 Volts. Plier pulls fuses from 10 to 100 Amperes. Shockproof. Requires the use of only **one hand.** Can be obtained from General Electric or Westinghouse stores, local electric dealers or direct from us, **postpaid.**

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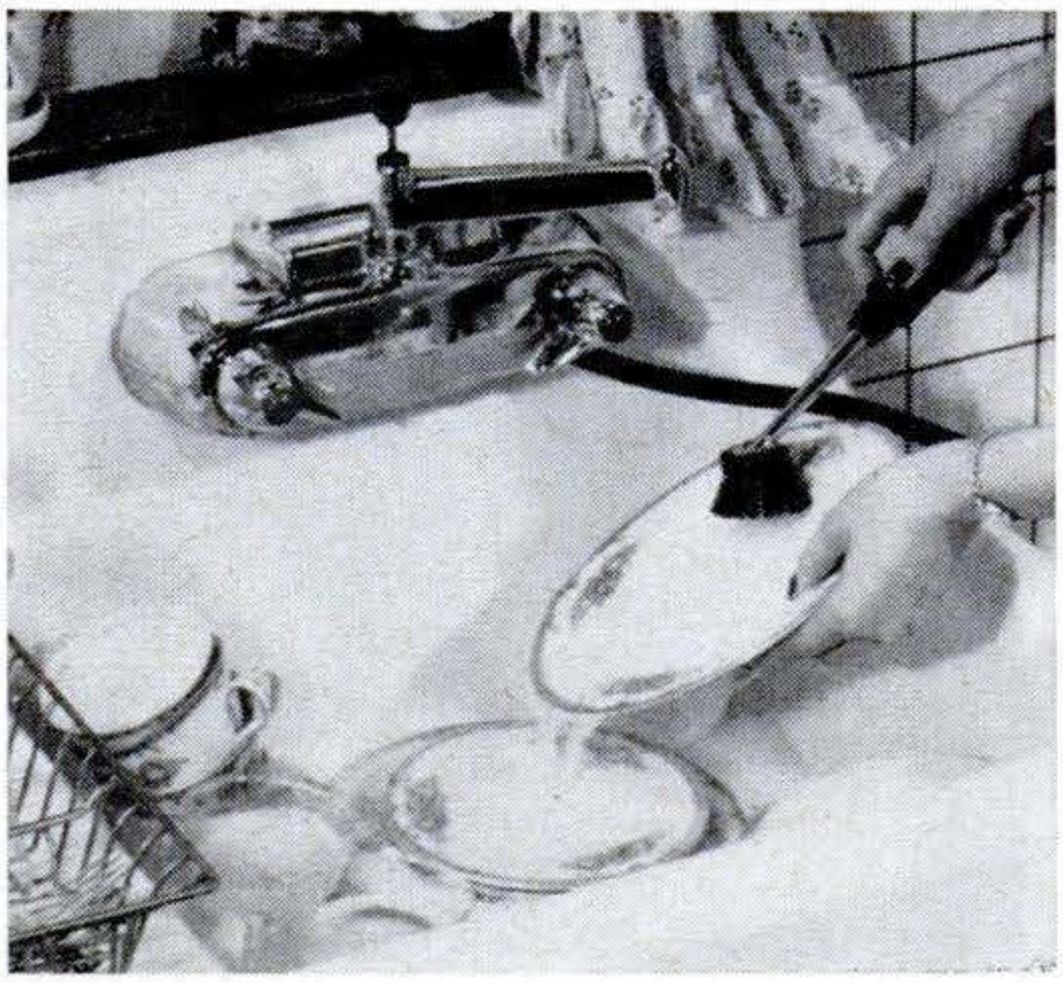
Aids to Modern Living



Speeds Dish Washing. Installed in place of the regular faucet assembly, the Dishmaster® mixes air, water, and detergent and then passes it through the spray handle that has a circular brush tip. Pressing and releasing a control button on the handle gives either suds or rinse water. The housing, handles, and brush rest are zinc die castings. Distributor is the Gerity-Michigan Corp., Adrian, Mich.

Spinning Disk Dumps Ashes. Finger pressure on the plunger drops the central disk in this ashtray and starts it whirling. Centrifugal force throws cigarette stubs and ashes into the container where smoke and tobacco odors are sealed in when the disk comes up. The distributor, Rexon, Inc., of New York City, markets the ashtray for about $6 to $8, depending on the finish of bronze or chrome.

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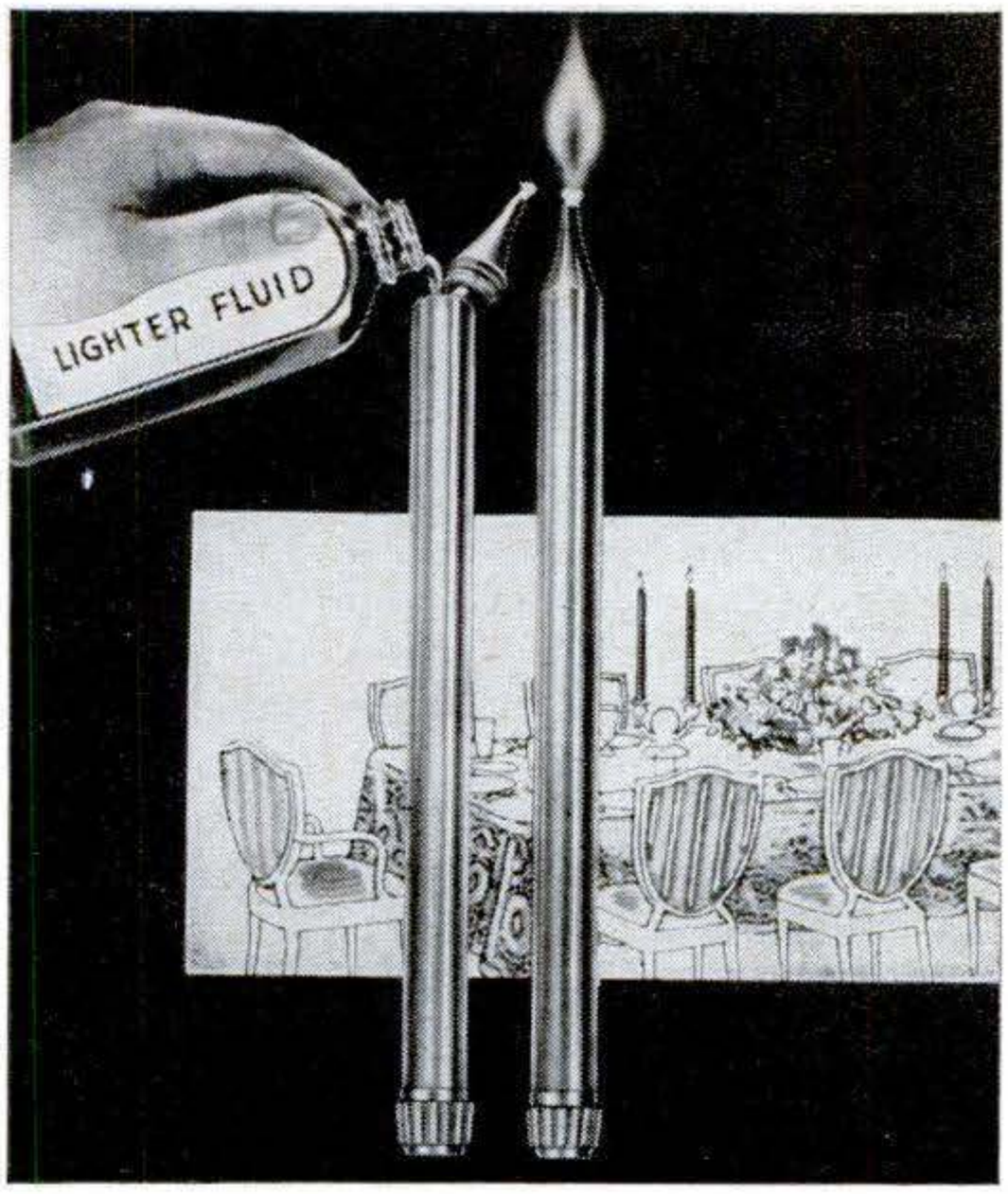
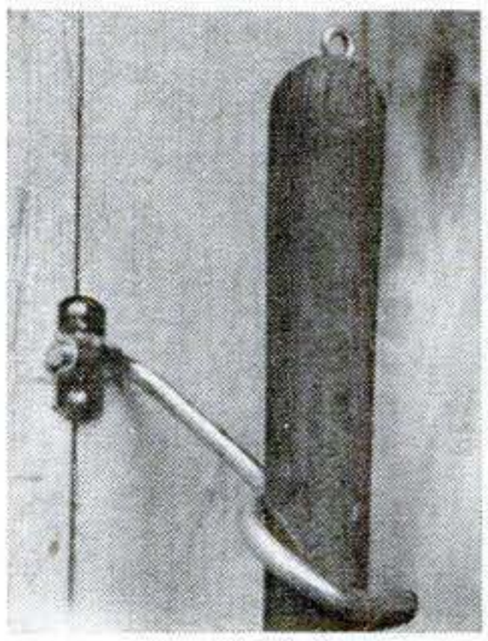


Candles Burn Lighter Fluid. Made of aluminum alloy, Anoware Everlasting Candles® offer decorative charm without the usual dripping wax. The hollow center, filled with lighter fluid, contains four hours' fuel. Priced about $4 a pair by H. G. Erstrom Engineers, Chicago.

Your Photo on Playing Cards. Robinson-Sherman Playing Cards, of New York City, offer decks of cards with either your photo or a caricature of yourself as decorations on the backs. The caricature cards show you at your hobby or favorite sport. If you're a golfer, for example, they'll picture you dubbing a tee shot. The photo cards are priced at $8.60 for two decks; the caricature cards at $11.60 for two.

Hook Hangs Up Tools. Garden implements, mops, carpet sweepers, and brooms are racked up by the Hang-It® wall hook, manufactured by Gardex Inc., of Michigan City, Ind. A groove and stop holds the hook away from the wall so tools may be inserted or removed with one hand. The hook, priced at 10 cents, is steel that has been plated against rust. It holds metal or wooden handles.



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COMPLETE CARVING SET

Here's everything you need for a super-slick job, from toothpicks to totem poles. Super-sharp blades, firm-grip handles for light and heavy work. Ideal for wood, linoleum, plastics, etc. Contains: 6 different gouges, 4 routers, 2 punches, 6 regular blades, 2 three-inch blades, one No. 1 knife, one No. 5 knife. On wooden block, complete.....*Only* **$5.00**

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Complete Instruction for Professional Use and 'Round-the-House Jobs—Includes Auto Painting and Refinishing

Get this new 1948 spray painting book to help you on the job or for better and time-saving paint work around the home and car. Thoroughly practical—covers every phase of spray painting technique. Tells what paint or other finish to use, how to mix colors, how to make perfect jobs, easy, quick.

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Remove paint, varnish, enamel, lacquer, or shellac—without burning, without hard scraping! Wonder-paste does the trick quickly, easily. That's why painters have been using it for years.

Simply apply Wonder-Paste directly over the old finish with a paint brush. Allow time for complete penetration—then slide off the soft, sludgy mass with a putty knife. Leaves no raised grain or scorched areas to be sanded. *Write for Wonder-Paste Leaflet* and ask for advice on your particular removing problem. Get Wonder-Paste from your paint or hardware store.

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TO: Reader
FROM: Editor

Crossing Our ⓣs

YOU may have wondered about the little Ts sprinkled through the editorial pages of POPULAR SCIENCE. Although they are identified on the contents page in every issue, a fuller explanation seems to be in order.

Many publications avoid trade names in their text as they avoid obscenity. Many magazines would paint out the name plate of an automobile in a photograph—as if that fooled anybody who knew his Pierce Arrows! Some newspapers still go to ludicrous lengths to avoid mentioning the name of a magazine. You may have noticed rather important pronouncements freely quoted from an article in "a weekly magazine." When what the General said in the *Saturday Evening Post* was common talk.

The tradition that commercial names should not profane the editorial columns had reasonable roots. As custodians of reader interest, editors have always had to resist the persuasions of persons and properties who would like their importance amplified and their shortcomings concealed. So editors have leaned over backward—an uncomfortable stance in which to fight real encroachment effectively. But, as magazines and newspapers have—with their readers—acquired a more adult attitude, such postures of knightly purity seem as antiquated as iron shirts.

Nowadays, you can read in *Time* that President Wilson of General Motors "chain-smokes Chesterfields." Or in *Outdoor Life* that the hunter cuddled his Winchester to his cheek and lined up the cross hairs of the Lyman sight on the shoulder of the mountain goat. Even in fiction, the hero meets the girl in a Greyhound bus—and the girl smells interestingly of Chanel No. 5.

This naming names is old stuff in POPULAR SCIENCE, which aims at being useful. In this magazine, names are facts as pertinent as dimensions. Our writers don't mumble vaguely about wire used in a heating coil as "a special alloy." We call it Nichrome®, and that's what you ask for at the hardware store.

We had our troubles trying to be truly useful and factual. Not even our experts know everything, and sometimes they would fail to put a trade-marked name in capitals or quotes. What was worse, the eagle-eyed beagles in our copy room (where ostensible facts are scrutinized suspiciously) have found no quick way to tell the trade-marks from the trade names.

There is a legal difference: a trade-*mark* is registered at the U. S. Patent Office. It is a valuable piece of property privately owned by the company using it and registering it. Technically, a trade-*mark* must be so identified every time it is used—on the label and package, in an advertisement or editorial article—by capital letters, or a footnote, or the letter R in a circle. Like the letter C in a circle that denotes copyrighted material.

But too many companies are careless about identifying trade-*marks*. And a lot of names used in the trade are not, or cannot, be registered. To be of practical service to readers, we have defined all commercial names as "trade *names*," whether registered as trade-*marks* or not. We start them off with a capital letter, which covers the technicalities, and a few issues ago we began identifying them with a letter T in a circle.

Soon, we got a friendly letter from the Trumbull people in Connecticut telling us that the plain capital T in a circle was *their* trade-mark for their electrical products. So we substituted, as soon as we could, a different T. Finally the printers came through with a lower-case t in an oval, which we hope will keep everybody happy. Since POPULAR SCIENCE goes to press in three different pieces at different times and places, it may take a little time to standardize on the new mark throughout the magazine.

Ⓣ

I hope this answers the questions raised by readers and manufacturers. And that both appreciate the practical values of knowing the name of a product or material by which it is known in the trade, in the stores and factories, and in the workshops and living rooms of America.

Ⓣ

ⓣ

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AMAZINGLY STRONGER

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Facts for Architects and Builders

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Melts at—340°F.

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Impact Strength — Greater than conventional screening.

Installation — Cut with ordinary scissors. Fold cut edges under one-half inch. Tack every 1½ inches through two thicknesses. . . . Being elastic, Lumite will automatically draw itself into a snug, firm fit.

Insist On Rustproof Screening

It's true. You can now get rustproof screening and save money, too! LUMITE, the new miracle plastic, actually costs only 11½-12¢ per square foot — much less than any other quality screening.

And LUMITE lasts longer because it never rusts or corrodes. It never stains paint under windows . . . never needs painting to prevent rust in any climate, anywhere.

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Guaranteed by Good Housekeeping — Replacement or Refund of Money if not as advertised therein

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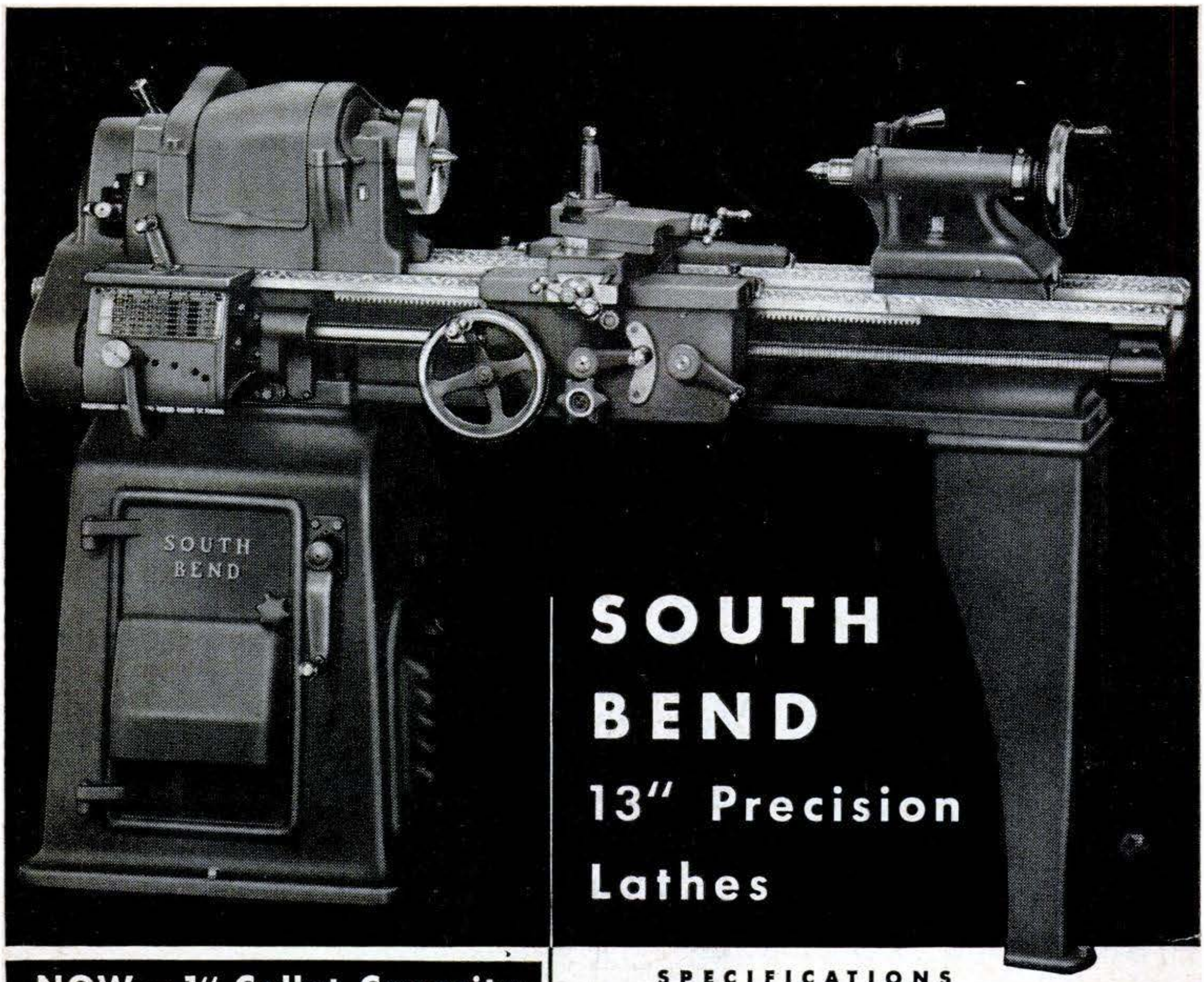

SOUTH BEND

13" Precision Lathes

NOW – 1" Collet Capacity

Catalog No. 145-B 13" x 5' Quick Change Gear Lathe with 3 phase, 60 cycle, 220 volt, A.C. motor and drum switch; f. o. b. factory $1332.25

South Bend 13" Precision Lathes now offer even more advantages where close-tolerance machining is required. They are economical, accurate, fast, and versatile. The new headstock with increased collet capacity permits a greater variety of collet jobs. Substantial savings in capital investment, floor space, and labor cost often result from their installation.

The Quick Change Gear model is popular for production operations, maintenance and service work. The Toolroom model has sufficient capacity for a large variety of toolroom work—its accuracy insures perfect results. Numerous tools and attachments are available for special jobs. Other South Bend Precision Lathes are made with 9", 10", 14½", 16", and 16/24" swings. Also Precision Turret Lathes with ½" and 1" collet capacities, a 14" Drill Press in bench and floor models, and a 7" Bench Shaper. Immediate deliveries can be made. Time Payment Plan is available.

SPECIFICATIONS

SWINGS: 13-1/8" over bed and saddle wings; 8-3/4" over saddle with chip guard removed.

BED LENGTHS . . . . . 4, 5, 6, and 7 feet

DISTANCE BETWEEN CENTERS . . . . . 16 to 52 inches

MAXIMUM COLLET CAPACITY: 1" (Collets interchangeable with South Bend 10"-1" collet, Series 1000, 14½", 16", 16/24" Lathes)

SPINDLE BORE . . . . . 1-3/8 inch

SPINDLE SPEEDS: Eight . . . . . 34 to 875 r.p.m.

POWER LONGITUDINAL FEEDS: 48 R.H. or L.H., .0015" to .0841"

POWER CROSS FEEDS: 48 . . . . . .0006" to .0312"

THREAD CUTTING: 48 R.H. or L.H. pitches . . 4 to 224 per inch

CROSS SLIDE TRAVEL . . . . . 8-1/8 inches

TAILSTOCK TOP SET-OVER . . . . . 15/16"

***Write* FOR THIS CATALOG NO. 73**

Describes and illustrates new South Bend 13" Precision Lathes with 1" maximum collet capacity. Includes complete specifications and prices.

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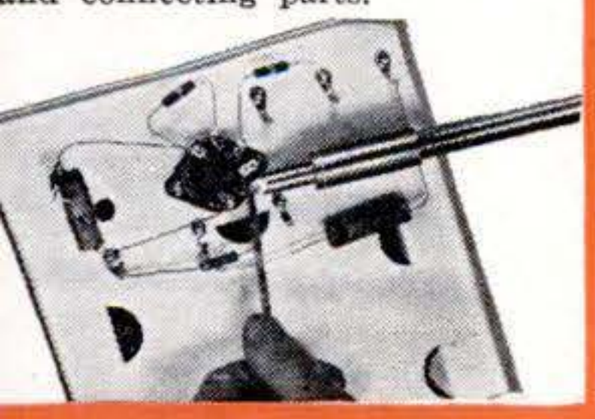

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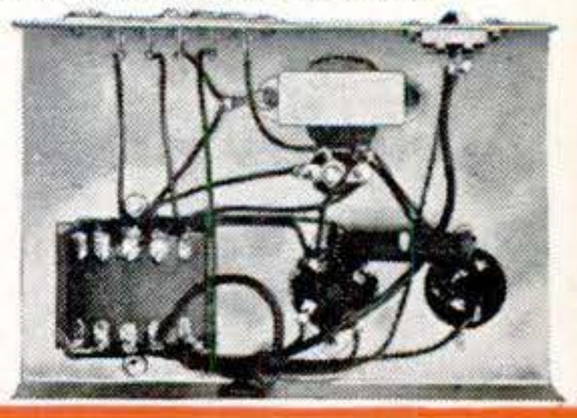
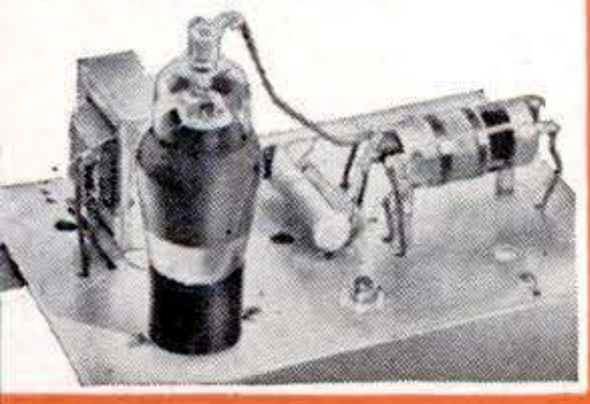
YOU TEST Radio Circuits like this built with parts I send. Build special circuits; learn how to locate and repair circuit defects.

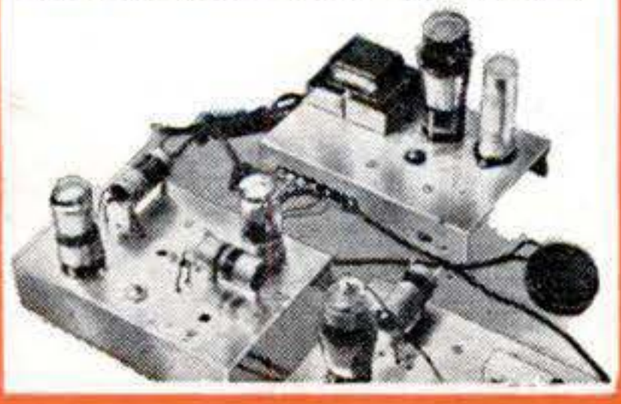
YOU BUILD Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds. Learn how to correct Power Pack troubles.



YOU BUILD this A. M. Signal Generator for more valuable experience. It provides amplitude-modulated signals for many tests and experiments.



YOU PRACTICE FM (Frequency Modulation) experiments, get more experience with this Superheterodyne Receiver Circuit you build with parts I send.



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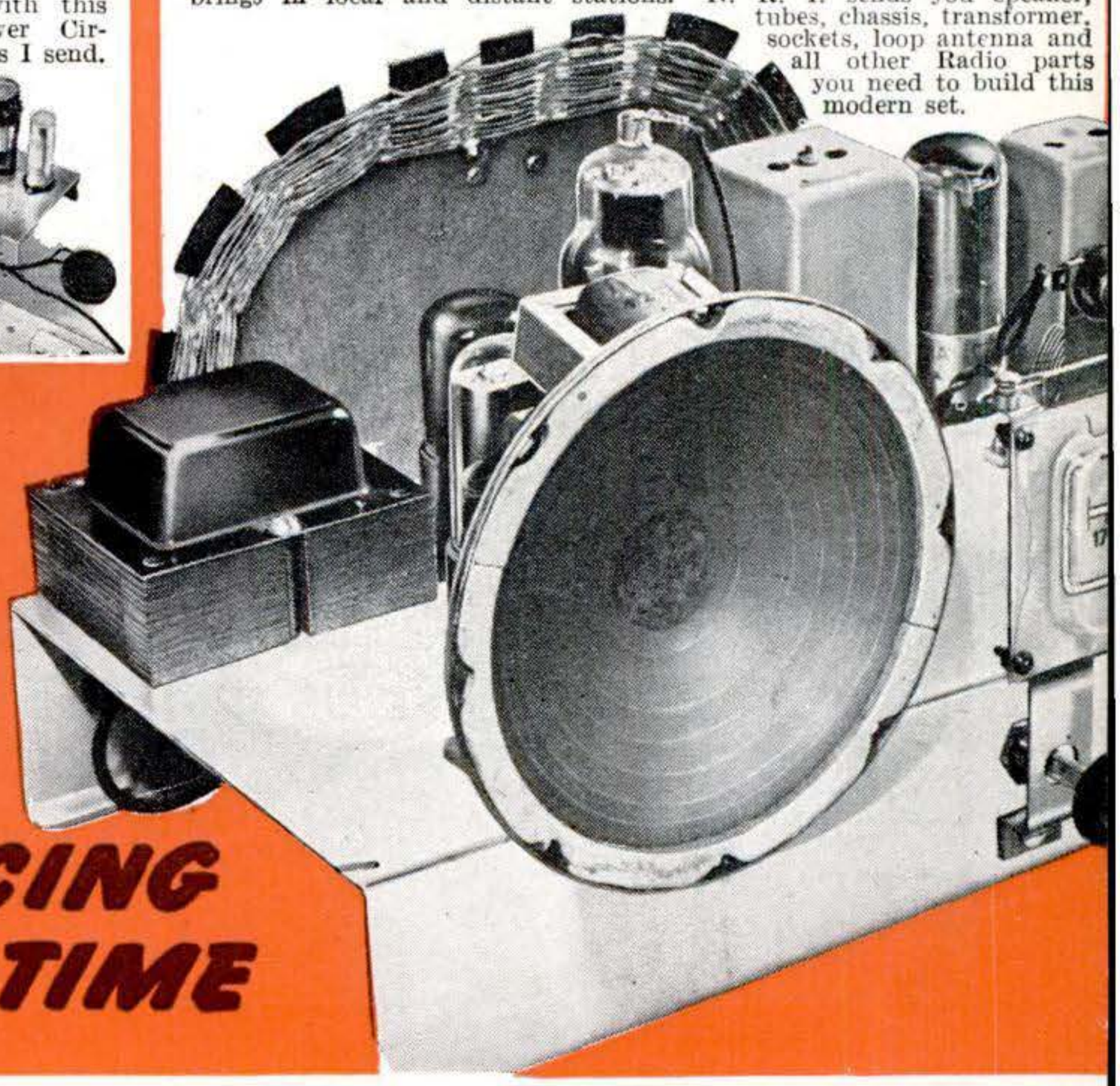

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